Food, physical activity and climate change perspectives in relationship to allotment ownership.

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Dissertation submitted in accordance with the requirements of the University of Chester for the degree of Master of Science (Public Health Nutrition).

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DECLARATION OF ORIGINAL WORK

I hereby declare that work contained in herewith is original and entirely my own work
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Signed ..... Date

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A. Hunt

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Abstract

Obesity and climate change are two of the biggest public health crises that the world currently faces and will face for many years to come, unless action is taken to halt the causes. The link between diet, physical activity and obesity has been firmly established. The causes of obesity are however, a multi-faceted problem, as are the causes of climate change. Current food production has been linked to increasing levels of CO_2, and current eating habits can be responsible for a large carbon footprint. Growing your own food has been suggested as a method of reducing one's carbon footprint, increasing physical activity levels and improving diet, little evidence exists to support this theory. This study looks at the fruit and vegetable consumption, physical activity levels and climate change awareness of allotment holders in two wards of Stockport.

Qualitative and quantitative data was collected via face to face questionnaires (n=28) at both allotments sites.

Fruit and vegetable intakes of allotment holders were above those of the U.K. general public and intake increased after allotment ownership. Physical activity levels were on average, higher than the recommendation of thirty minutes a day for at least five days per week and generally increased after uptake of the allotment. Allotment owners rent their plots for a combination of reasons, the majority wanting to grow their own food, and get exercise and most also cite some form of environmental issue. All participants were aware of climate change and although not all thought it would affect allotments; most had ideas of what they would do to adapt to changes.

There are synergies between solving climate change issues, such as Green House Gas emissions and improving our health, both physically and nutritionally. Growing your own fruit and vegetables on an allotment can increase your consumption of fruit and vegetables significantly, increase your exercise levels and reduce your CO_2 emissions.

AKNOWLEDGEMENTS

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CO_2	Carbon Dioxide
F & V	Fruit and vegetables
FFQ	Food Frequency Questionnaire
GHG's	Green house gases
GYO	Grow your own
MET	Metabolic Equivalent
PCT	Primary Care Trust
PIS	Participant Information Sheet

Chapter 1: INTRODUCTION

'There is a huge potential to improve the quality of people's lives and to reduce long-term costs for the health service by focusing on prevention.'(Wanless, 2002).

1.1 Public Health Nutrition

There are many different definitions of Public Health Nutrition but most stress the promotion of good health, based on eating a healthy diet and exercising. The Nutrition Society in the U.K. has the following definition:

"Public health nutrition focuses on the promotion of good health through nutrition and the primary prevention of diet-related illness in the population. The emphasis is on the maintenance of wellness in the whole population" (Landman, Buttriss and Margetts ,1998)

Interestingly the Australian view point takes this a little further and goes on to include sustainability and the environment in the definition:

'Public health nutrition is the art and science of promoting population health status via sustainable improvements in the food and nutrition system. Based upon public health principles, it is a set of comprehensive and collaborative activities, ecological in perspective and intersectoral in scope, including environmental, educational, economic, technical and legislative measures (Hughes and Somerset, 1997)

1.2 Climate Change

By including the environment the Australians make this a very forward thinking definition as currently, "Climate change is the greatest environmental challenge facing the world today". (Department for Environment, Food and Rural Affairs [Defra], 2008). Thus this definition should be more widely accepted. Large

changes in our climate have been implicated as a major global issue, which must be internationally controlled and managed in order to prevent the prevailing health problems, food insecurities and extreme weather conditions. The majority of climate change is caused by human activity. The latest (2007) report by the Intergovernmental Panel for Climate Change (IPCC) states that even if the world were to halt the emissions of green house gases (GHGs), we are 'committed' to a rise of 1^{o}C by the end of the century or 0.1^{o}C per decade

In order to appreciate *climate change,* it is important to understand that there is a difference in weather and climate. Weather is observed on a daily basis and is described by the Met Office as, the temperature, precipitation (rain, sleet, snow and hail) and wind and these change hour by hour, whereas climate is the average change in weather and the variations with time, accepted internationally as 30 years. Climate change is defined by Bernstein et al. (2007) as: "A change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer."

Defra (2008) and their government predecessors, have measured changes in climate and state that over the last 100 year's U. K. temperatures have increased by 0.74°C and it is estimated that the Earth has warmed by 0.4°C in the last 40 years. This rise in temperature is causing extreme weather changes across the world including; weather pattern changes, heat waves, increased landslides, typhoons, tornadoes and hurricanes, as the oceans heat up, droughts and flooding. A major consequence of these changes will be food shortage and spread of disease. The World Health Organisation [WHO] (2005) refers to malnutrition as a 'climate sensitive disease' and specifies the importance of education to vulnerable populations to raise awareness of climate change and the health implications.

The United Kingdom Climate Impacts Program (UKCIP) works to predict the changes in the UK in order to assess how changes will affect different sectors. The report published in 2002 predicted that summers will be warmer and drier, winters would be wetter. Warmer temperature may appear beneficial but there will be an increase in extremes of weather such as very hot dry summers, very wet winters and stronger winds, increases in diseases e.g. malaria for humans and pests for plants crops and domestic animals. In the North West of England, agricultural practices may have to change significantly to adapt to longer growing seasons and reduced soil moisture (Potter, 2008.) which may have an effect on the supply of locally produced foods and push prices higher. **Figure 1** shows the climatic hardiness zones of the British Isles. Hardiness is defined by the resilience of plants to certain temperatures. The Pennines are classified as zones 7 and 8, with 8 being milder areas and 7 being colder areas. These zones will be affected as the climate changes, thus affecting food production.

Key

- Zone 7 - In Scotland the Grampians, Highlands and locally in the Southern Uplands, in England the Pennines and in Wales the highest part of Snowdonia.
- Zone 8. Most of England, Wales and Scotland, and parts of central Ireland.
- Zone 9. Most of western and southern England and Wales, western Scotland, also a very narrow coastal fringe on the east coast of Scotland and northeast England (within 5 km of the North Sea), London, and most of Ireland.
- Zone 10. Very low lying coastal areas of the southwest of Ireland and the Isles of Scilly

Figure 1 Map of the British Isles climatic zones, (adapted from http://www.trebrown.com/hrdzone.html)

1.2.1 Climate change and food production

If, as previously stated most climate change is due to human activity, it would make sense to examine areas of human activity that can potentially change the output of Green house gases (GHGs) such as carbon dioxide (CO_2) and therefore the contribution that food production makes. Food production is responsible for an estimated one- fifth of total UK greenhouse gas emissions and is a major source of waste (Sustainable Development Commission [SDC], 2008).

The focus of food production and climate change has mainly taken the form of discussion of 'food miles', a generalised term which refers to the environmental impact of the transportation of food due to globalised food systems.

In fact food production is now so energy-intensive that more carbon is emitted providing a person with enough calories to walk to the shops than a car would emit over the same distance (Goodall, 2007). The increase in demand for convenience foods has lead to increased CO_2 emissions from the production and processing and the plastic (oil rich) packaging (Stern, 2006).

1.2.2 Allotments and sustainability

In 1998, many local authorities linked allotments to Local Agenda 21[*](LA 21) initiatives. This has drawn support from central government and Parliament as well from LA 21 campaigners. The Local Government Association has recognised the value of encouraging the linkage between the two and sees possibilities to form new

[*] Agenda 21: "is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System and Governments in every area in which humans impact on the environment" (UN 2004). The aim is to meets the needs of the present without compromising the ability of future generations to meet their own needs.(Brundtland's definition of sustainable development (1997)

partnerships between allotment groups and members of the environmental health, teaching, and health visitor professionals. Allotments are seen as a sustainable leisure activity, with the added benefits of providing good food, exercise and a sense of community (House of Commons 1998a).

Food 2030 (Defra, 2010) is a government strategy, in which it is proposed that a sustainable and secure food system is developed. **Figure 2** below indicates how allotments and community growing schemes could easily fit into 'enabling and encouraging people to eat a healthy, sustainable diet'

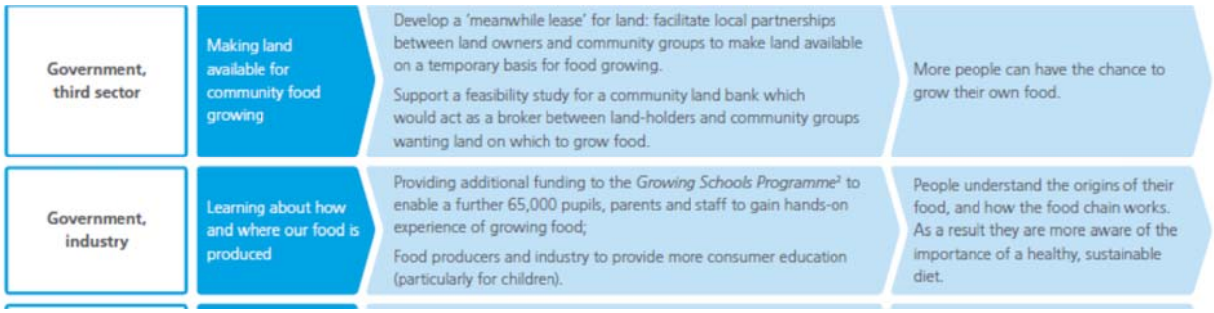


Figure 2 Government recommendations for making sustainable food more accessible.
Source Defra (2010)

1.3 Study area: - Stockport

Stockport is one of Greater Manchester's ten Metropolitan districts and stretches from central Manchester to the Peak district, covering an area of 126km^2. Stockport lies at the south-eastern edge of the conurbation at the junction of the Cheshire Plain and the foothills of the Pennines. **Figure 3** Provides a brief overview of the area and its geography.

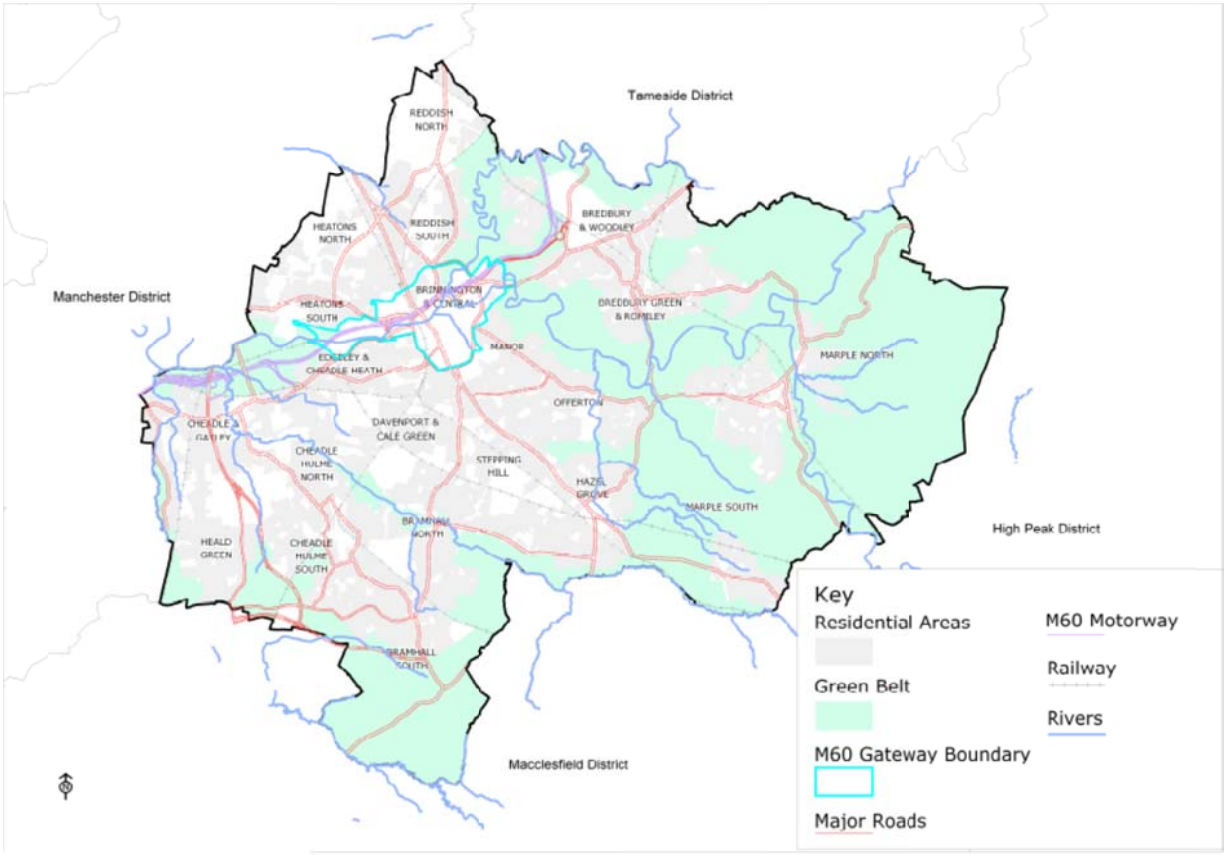


Figure 3 The Borough of Stockport

1.4 Health Trends

The North West of England already has some of the highest levels of dietary related ill health in the country, fostered by easy access to processed, ready meals, fast foods and snacks, which are often low in nutrients and high in fat, sugar and salt.

People living in the more deprived areas and low income families have the worst diets (Potter, 2008).

This is also summed up by Jeanette Longfield of Sustain (2001)

'if we compare the nutrient quota of the richest and the poorest families there is almost no difference at all. Rich people just eat 'posh fat'. The real difference is in fruit and vegetables.'

Currently, a large proportion of the population in England are eating less than the recommended amount of fruit and vegetables (Defra, 2008), with only 28% of men and 32% of women consuming five or more of the guideline recommendations for fruit and vegetables.(National Health Service [NHS] 2008.)

The percentage of respondents who reported eating the recommended five or more portions of fruit and vegetables per day was lower in Stockport (19%) than England (25%) (Department of Health (DOH), 2003)

1.4.1 Obesity

Current trends in obesity predicted by the Foresight report suggests that by 2015 in the UK, 36% of adult males and 28% of females will be obese; by 2025, these figures are estimated to rise to 47% and 36% respectively and by 2050, 60% of males and 50% of females could be obese and Britain could be 'a mainly obese society' (McPherson, Marsh and Brown, 2007) potentially costing society £50B (DOH 2008). **Figures 4 and 5** show the changing body mass indices (BMI's) and predictions for the future, for men and woman, over the period of 1993 - 2050 (McPherson et al., 2007).

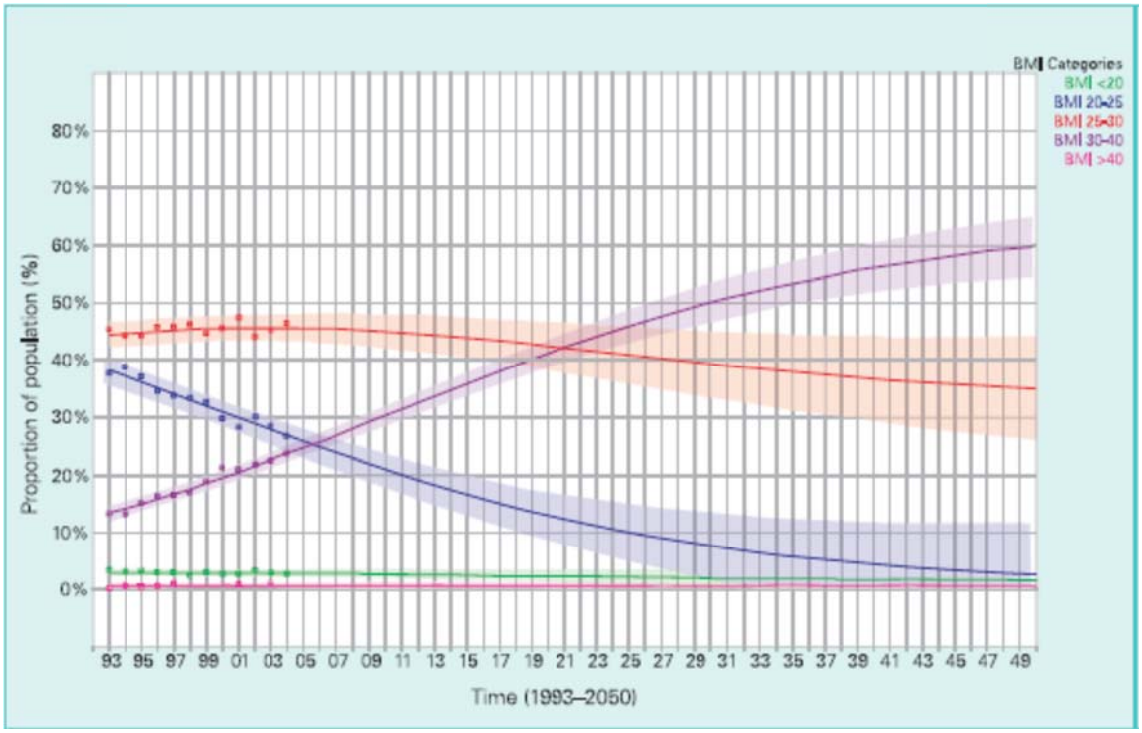


Figure 4 Proportion of males ages 21-60 belonging to different BMI categories in a given year

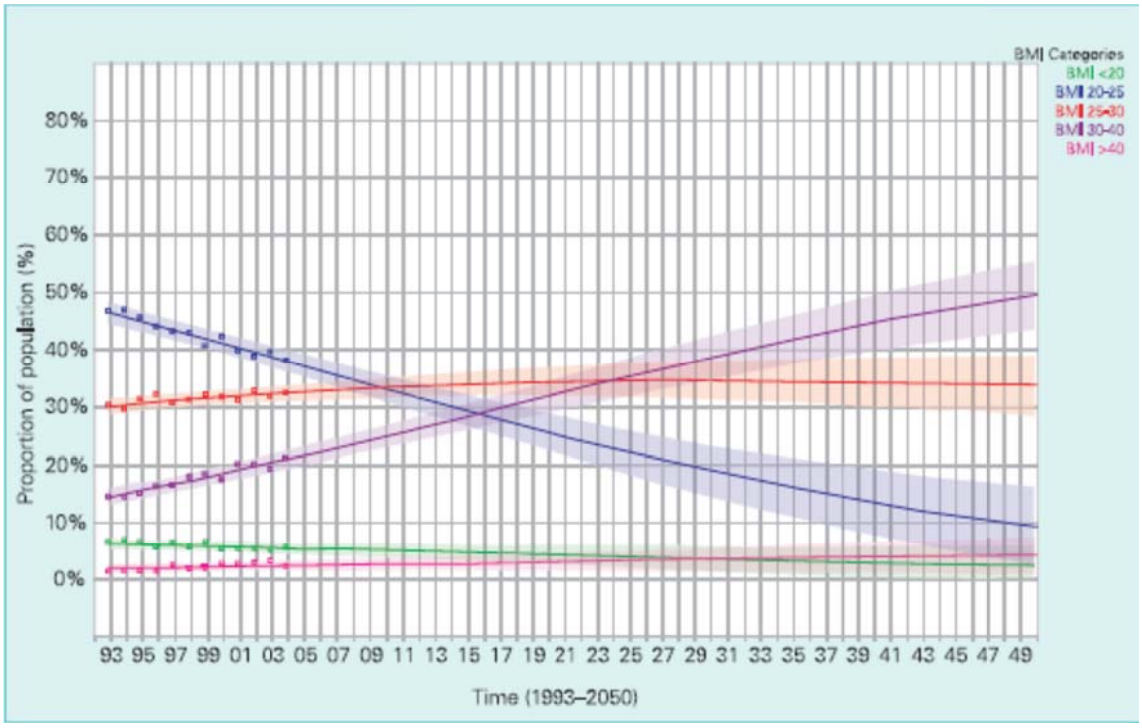


Figure 5 Proportion of females ages 21-60 belonging to different BMI categories in a given year

Figures released by the DOH (2008) reveal that in the UK almost 65% of men, 56% of women (**Figure 6**) and almost a fifth of 1-5 year olds are either overweight or obese. **Figure 7** shows the obesity map for the U.K. listed by Primary Care Trust.

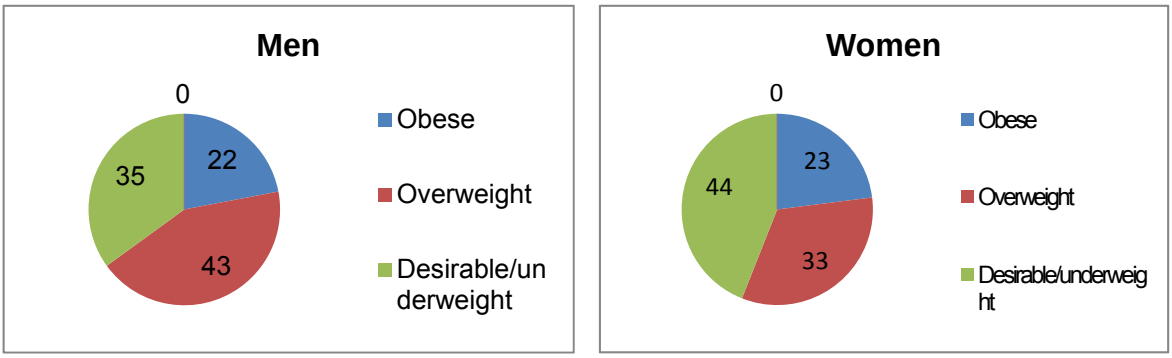


Figure 6 Prevalence of Obesity: Source: Adapted from DOH (2008)

Figure 7 The obesity map for the UK by PCT. (Dr Foster, 2008)

If predicted estimates of obesity are applied to the projected population of Stockport (**Figure 7**) this would equate to 74,100 obese people aged 16+ in 2015, 96,650 obese people aged 16+ in 2025 and 130,750 obese people aged 16+ in 2050 (using 2029 population projections). This means an increase of 21,600 adults between 2005 and 2015, an increase of 22,600 between 2015 and 2025 and an increase of 34,100 between 2025 and 2050 (Stockport JNSA, 2007).

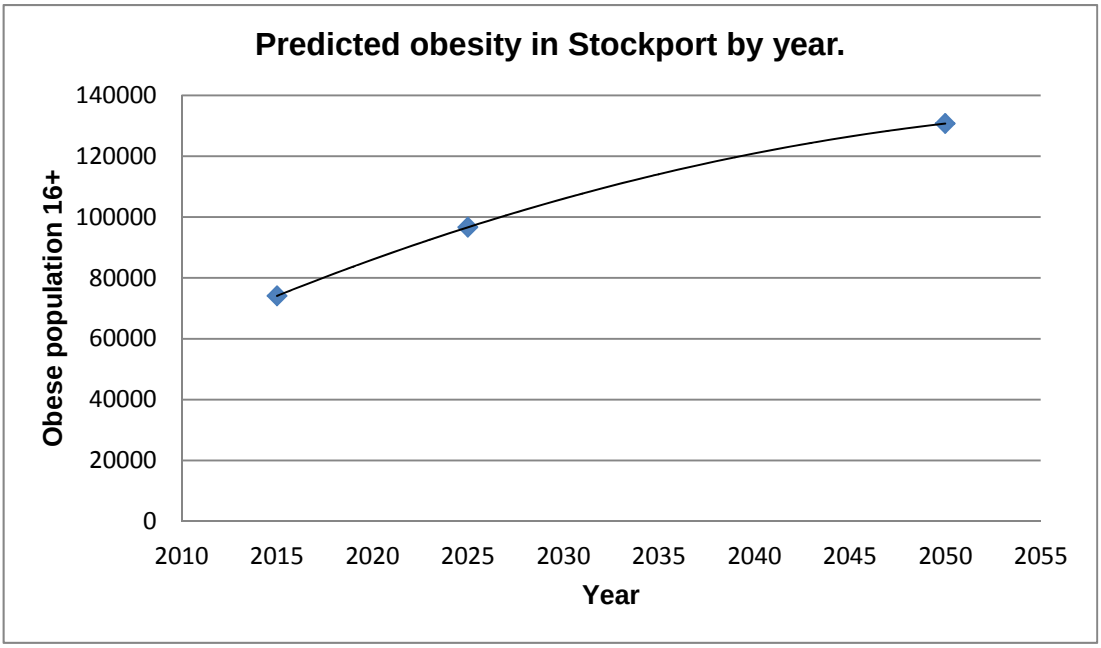


Figure 8 Obesity predictions for Stockport

Obesity is strongly linked to chronic lifestyle diseases such as heart disease, stroke, some cancers and type 2 diabetes. Early deaths from heart disease and stroke in the North West are significantly higher than the England average and higher than any other region (with the exception of the North East). Of all the local authorities in England, Manchester has the greatest rate of early deaths from heart disease and stroke (151 deaths per 100,000 population) (Stockport, JNSA, 2007).

Using the Index of Multiple Deprivation, Stockport ranks 159th out of 354 local authorities. This shows that Stockport as a whole, is average in terms of deprivation, however, Stockport is one of the most polarised boroughs, ranking 7th

out of 354 local authorities in the country demonstrating a very wide difference between the most and the least deprived areas within the borough (LDF Core strategy).

The most deprived areas of Stockport are concentrated in the north and central parts of the borough, including Brinnington, Reddish, Adswood and Cale Green. Childhood obesity in the wards of North Heaton's and South Reddish in Reception classes of primary school children in 2008-2009 were measured at 4.7 and 7.8 respectively (Source APHO and Department of Health © Crown copyright 2008).

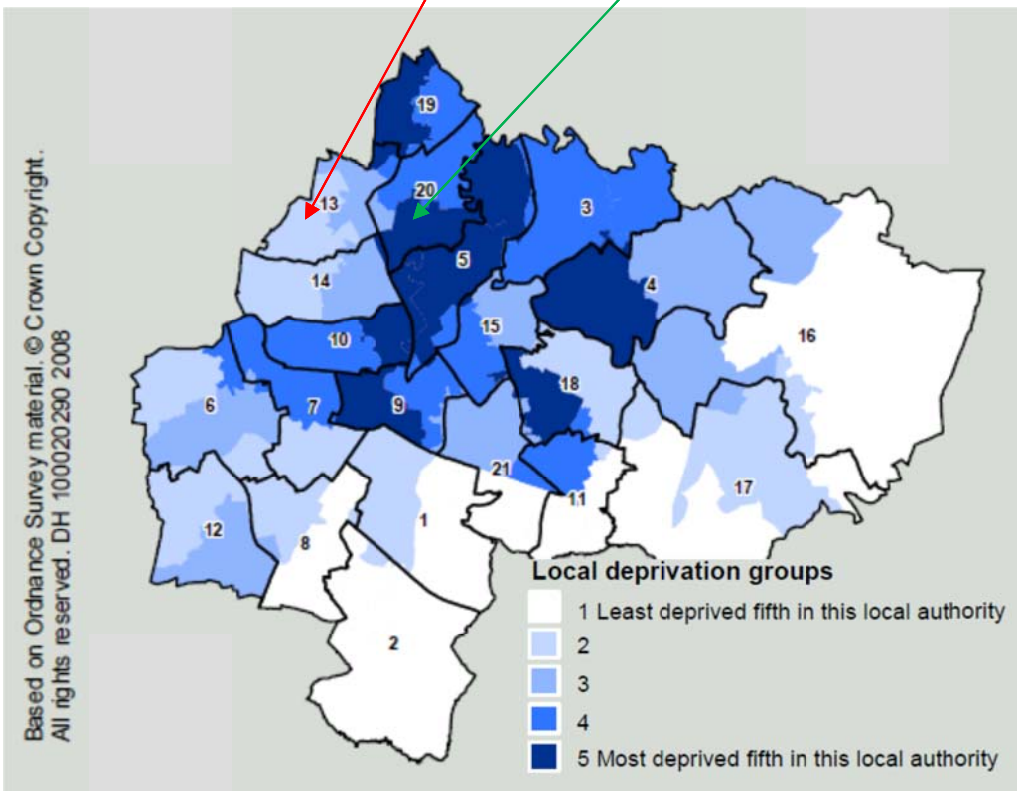


Figure 9 Childhood obesity in reception classes of Stockport

1.5 Physical activity

Physical activity is also linked to obesity and lifestyle disease, with adults who are physically active having 20-30% reduced risk of premature death, and up to 50% reduced risk of developing major chronic diseases such as coronary heart disease, stroke, diabetes, and cancers. However, physical activity levels are declining nationally and we are leading increasingly sedentary lifestyles and according to Prentice and Jebb (1995) the increase in obesity is more strongly related to lack of exercise than food intake.

The World Health Organisation's recommendations for physical activity are summarised below: **Table 1**

Table 1 WHO and England's recommendations for adult physical activity

	Age	Activity level Either	Or	Duration
WHO	18-64	Moderate for 150 mins thought the week	Vigorous for 75 mins	Bouts of 10 mins
England Chief Medical Officer 2004	18+	At least moderate activity on 5 or more days a week		30 mins

Physical activity levels in the North West are only slightly lower than the national average (Active People Survey, 2006). Across the region, 20.6% of adults take part on at least three days a week in moderate intensity sport and active recreation for at least 30 minutes continuously in any one session. The national average is 21%.

Compared with national figures, younger Stockport adults are more sedentary than average whereas older age groups report being more physically active. This suggests that older people in Stockport are fitter than their national average age

group, possibly working in their retirement and younger adults are less fit than their age group nationally.

Physical activity is effective in the treatment of mental illness and enhances well-being, however, the opportunities for 'green exercise', including use of allotments and parks, are not being maximised by the population.

1.6 Allotments

In the UK, allotments are small parcels of land rented to individuals usually for the purpose of growing food crops. There is no set standard size but the most common plot is 10 rods, an ancient measurement equivalent to 302 square yards or 253 square metres.

Allotments have been an important and valuable part of both the rural and the urban community for over 150 years. They were created as a means to empower those on low incomes by providing a way in which they could grow their own food and thus improve the quality of their life, health and diet. The common land that these people worked was the remains of land that had once been communal agricultural land. The General Inclosure Act of 1845 made the provision of allotments for the 'labouring poor' mandatory and introduced the concept of landlord and tenant for allotment land.

The 1908 Allotments Act made allotments the responsibility of local authorities and a further Act in 1922 made allotments available to all, not simply those on low incomes.

A peak in allotment use was seen with the onset of World War II, as people responded to Britain's 'Dig for Victory' demand for self-sufficiency, with one and a half million plots being cultivated. During this period 1,400,000 plots were utilised to

produce 1,300,000 tonnes of food per annum, which equates to nearly 1 tonne of food per plot. Post war Britain saw a fall in allotment use due to changes in society with 'cheap' food and the negative stereotyping of allotment gardening as the leisure pursuit of those on low incomes, or the white, retired male.

The Allotments Act 1950 was the last update of allotment law and there remains the need for alteration in the law to reflect changes in allotment gardening. In modern allotment gardening, people of all ages and backgrounds are creating communities that produce fresh, healthy food and offer a healthy lifestyle too. In 1998 Defra, published a White Paper on the Future of Allotments. 'A Good Practice Guide' from the Local Government Association has followed this (2001). Both documents highlight the contribution that allotments make to an improved quality of life.

In addition, allotments are enjoying a resurgence, with more and more people benefiting from gardening as evidenced by growing waiting lists for allotments all over the country. Allotments also provide a practical opportunity for physical activity, better nutrition; encourage more fruit and vegetable consumption, organic production and potential reduction of food miles and carbon footprints.

Allotment use is currently getting high profile media, with both the Queen and Michelle Obama putting themselves forward as ambassadors of the 'grow your own' (GY0) movement and 'eat locally and organically' (BBC, 2009 and Times online, 2009, Food Navigator.com, 2009)

Figure 10 The Queen and Prince Philip talking with the head gardener in her new allotment

Figure 11 Michelle Obama raking the White House allotment.

The National Trust has begun a nationwide campaign to encourage landowners to lend spare plots to the public, reportedly creating 1000 more allotments.(National Trust,2009) Even Boris Johnson, the London mayor, has announced a scheme to plant vegetables on rooftops and unused spaces around some of the capital's most famous landmarks.(Times online, 2009)

In the UK there are an estimated 300,000 allotments (Pless-Mulloli , Air , Vizard , Singleton, Rimmer and Hartley ,2004) however, allotment sites in the North West are on average the smallest in area in England and host the fewest tenant plots compared to any other region. The average allotment cost per square metre is reported to be one of the highest in the North West, North East and London. (DCLG, 2006). Despite the large number of vacant plots in the North West, 31% of sites still have an average waiting time of over a year (DCLG 2006).

Recently the focus of allotment research has been in the area of mental health and well being, providing positive results for the beneficial effects of green space and mental well being. (Milligan, Gatrell and Bingley,2004). A literature review produced few findings on general diet and physical exercise.

Table 2 The Key potential health benefits of GYO in urban areas

Key potential health benefits of GYO in urban areas
Physiological
Multi-muscular exercise - improving cardiovascular function
Load bearing - reduced osteoporosis
Bending and stretching - increased general muscle tone
Outdoor exercise - 'fresh' air, sunshine
Nutritional
Fresh produce rich in vitamins and trace elements
Green leafy vegetables high in folic acid, iron and ascorbic acid
Brassicas (cabbage, cauliflower, broccoli, brussels sprouts, curly kale) rich in glucosinolates - implicated in preventing cancers
Legumes (peas, beans) are key components of the health protecting 'Mediterranean diet'
Berry fruits rich in anthocyanins, flavonoids and vitamin C
Apples rich in anti-oxidants implicated in cancer prevention
Sunlight exposure - leading to increased vitamin D synthesis in skin
Psychological
Sunlight exposure - increased serotonin (less winter-depression)
Sense of achievement and well-being - improved psychological health
Empowerment - independence/self sufficiency
Nature and greenspace interaction-increased well-being
Enhanced social networks and community interaction-increased well-being
Sense of community and belonging-increased well-being
(Adapted from Peraz-Vazquez et al. 2005).

Table 2 outlines the potential benefits from 'growing you own' fruit and vegetables, as suggested by Perez-Vazquez, Anderson and, Rogers (2005).

The focus of this research project is to establish if working allotments contribute positively to the improved health of their holders, offering both nutritional and exercise benefits combined with offering a means of reducing climate change effects, such as carbon footprints and food miles. Stockport is currently planning for obesity challenges and is offering allotment work as one of its priority solutions, planning to invest 100k on providing new allotments and green gyms.(Stockport PCT, 2009) It is hoped that the research will provide the evidence base for these plans. Recent research in the USA has shown a positive effect with1.4 times more daily fruit and vegetable portions being consumed by community gardeners than those who abstain from gardening (Alaimo, Packnett, Miles, Kruger ,2008). If a positive association is found, allotments could be the link to reducing obesity levels by providing improved diets with higher fruit and vegetable consumption and more exercise and to reducing the impact of climate change by increasing awareness of climate change issues, such as food miles and carbon footprints therefore helping to solve food production problems in a climate changing world.

1.7 Study Structure

1.7.1Aim

The present study aims to analyse the association between allotment ownership and health status, with a particular focus on fruit and vegetable consumption and physical activity levels, incorporating assessment of climate change knowledge.

1.7.2 Objectives:

1) To clarify the rationale for allotment use as a means of obesity reduction / prevention.

2) To determine the association between post and pre allotment use and fruit and vegetable consumption.

3) To determine the association between allotment use and physical activity levels .

4) To investigate perceived environmental impacts of allotment ownership

5) To determine if allotment users are planning for climate change

1.7.3 Hypotheses

Primary hypotheses for this study are:

1) Allotment owners consume significantly higher proportions of fruit and vegetables than the general public as determined by the Department of Health (2004).

2) Allotment owners consume significantly higher proportions of fruit and vegetables than prior to 'ownership' of an allotment

Secondary hypotheses are :

3) As a result of allotment ownership physical activity levels are significantly higher than the general public.

4) As a result of allotment ownership physical activity levels are significantly higher than prior to 'ownership'.

5) Allotment holders are aware of climate change by taking responsive action.

6) Socio-economic location has no effect on the findings – (Null hypothesis).

1.8 Allotments in this Study

The allotment sites used in this study are: Priestnall Allotment Society and Whitehill Allotment Society. They are geographically close but differ demographically and are located in different wards of Stockport, with Priestnall being found in North Heaton and Whitehill being found in South Reddish.

The location of the two allotment sites can be seen on the map of allotment sites in Stockport, **Figure 12.**

Figure 12: Location map of study allotment sites.

Priestnall is situated on the Heaton Moor / Heaton Mersey border, a reasonably affluent area of Stockport and is close to the ward boundary of North and South Heatons.

Figure 13 Arial view of Priestnall Allotment

The allotment site has 87 full sized plots and some are subdivided into ½ and ¼ plots to give enough for 135 allotment holders.

Figure 14 A typical ¼ allotment plot

Figure 15A typical ½ allotment plot

The soil is sandy and generally acidic, with the water table approx. 2 metres below the ground. This can make growing conditions fairly hard and the soil requires organic matter to produce reasonable growing results. The allotment site has over 70 names on its waiting list.

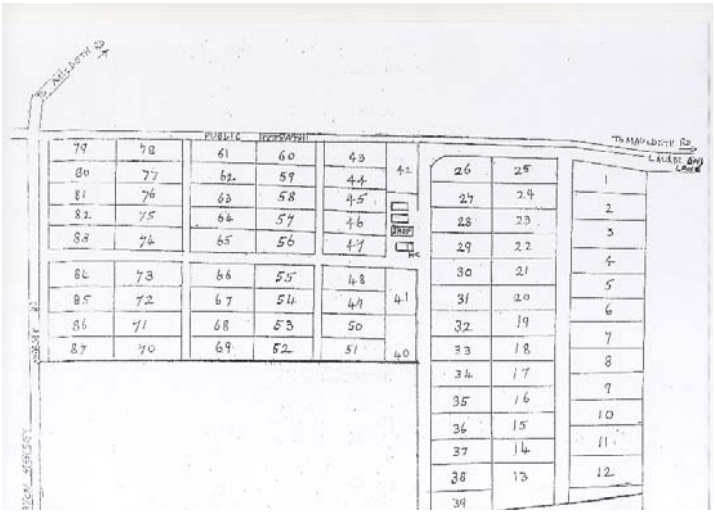


Figure 16 Plot layout for Priestnall Allotments

Whitehill is situated on the borders of Heaton Chapel, Heaton Norris and Reddish, on the outskirts of an industrial estate, next to a railway line. Housing in the locale is mainly two and three bedroom terraces.

Figure 17 Arial view of Whitehill allotments

The allotment site has 68 plots, with most of the plots nearest the road being used for poultry keeping (**Figure 18**)**,** leaving approx. 63 fruit and vegetable plots and 60 allotment holders (some allotment holders rent multiple plots and /or 'co-own' plots with other tenants). There is a waiting list of 5-10 people.

Figure 18 Poultry facilities at Whitehill Allotments.

The soil is predominantly clay based with some sandy soil and very damp, the water table is very near the surface and there are natural ponds present on the site. This can make growing conditions hard in certain plots. The ponds (**Figure 19**) have been incorporated into a wild-life area, complete with a 'port-a-cabin' classroom for use by the local school.

Figure 19: Wildlife Pond at Whitehill Allotments

A bee-keeping area has recently been established (**Figure 20**)

Figure 20 Recently set up apiary

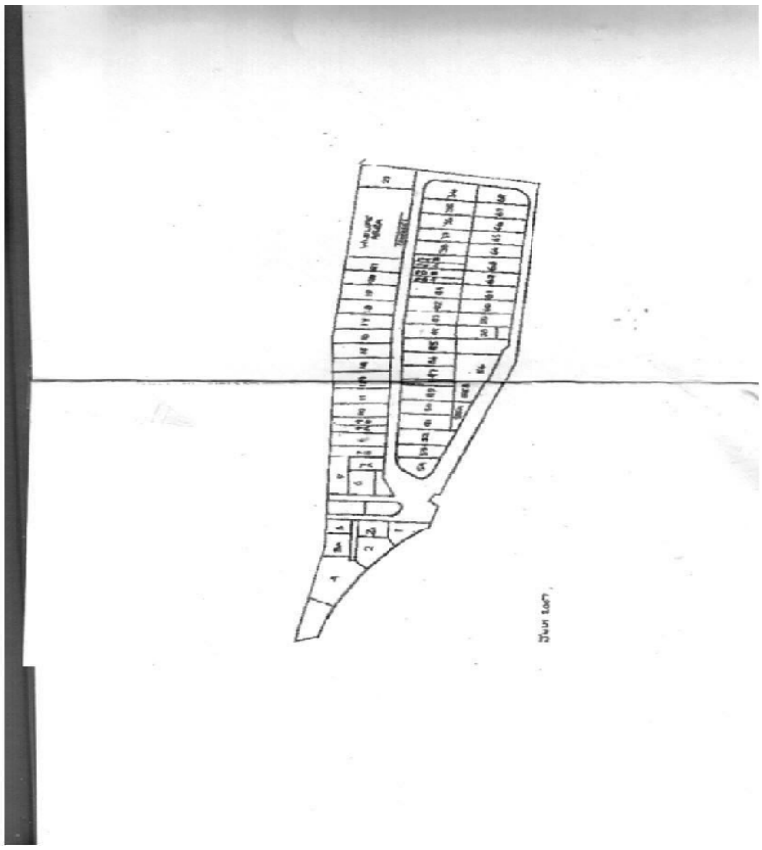


Figure 21: Plot layout for Whitehill Allotments.

Chapter 2 : METHODOLOGY

2.1 Literature review

A draft paper by Stockport Primary Care Trust [PCT] (2009) outlines plans to tackle obesity in the near future and one of the suggestions is the use of allotments as a method of introducing higher levels of fruit and vegetable consumption and increased exercise levels.

A literature review was undertaken from March 2009 to December 2009 initially to establish the 'need' for the research and to identify specific methods for determining fruit and vegetable consumption in similar circumstances, exercise levels and allotment usage and climate change knowledge/ awareness, as this rose up the political agenda. Searches were undertaken using both Medline and Cinahl Plus. Positive results for the beneficial effects of green space and mental well being, are well documented in the literature (Milligan, Gatrell and Bingley, 2004), however the literature review produced few findings on general diet and physical exercise, particularly in the U.K.

Allotments are an important green space and are noted as such by local councils, however, there is little literature on climate change as a motivation for allotment use. Two recent studies (Garratt, 2007 and Elbourne, 2009) have examined allotment use and other 'grow your own' projects as a method of reducing the carbon dioxide emissions of food production and importation. A more detailed view of this can be found in **Section 4.2.2**

Table 3 Outlines the most applicable studies of the literature review and is adapted from McCormack, Laska, Larson and M. Story (2010). The majority of the studies are based on populations in the U.S.

Table 3 - Studies examining the effects of 'growing your own' on nutritional outcomes.

Abbreviations: FV = Fruit and vegetables

Author(s), year (reference)	Country and area	Study population	Design (duration)	Measures	Measurement tools	Nutritional outcomes
Alaimo et al. , 2008	USA, MI	Adults (N=766)	Cross-sectional random phone survey	FV intake, participation in a community garden	Behavioural Risk Factor Surveillance System questions	Adults with household member participating in the garden consumed FV 1.4 times more per day than non participants, also 3.5 times more likely to consume at least 5 portions in a day.
Blair et al. , 1991	USA, PA	Gardeners and non-gardeners (n=144 and n= 67)	Cross-sectional case control matched survey	Nutritional, social and economic impacts	Nonquantitative food frequency questionnaire of FV and six other food categories consumed in the last month	Gardeners consumed considerable more of 6 categories of vegetables than non gardeners Gardens consumed significantly less fruit, milk product, sweets and sweet drinks than non gardeners.
Lackey et al., 1998	USA, WI	Gardeners and matched comparisons (n=123 and n=123). Stakeholder interviews (n=47)	Cross – sectional design using qualitative (interviews, garden participant observations) and quantitative post test surveys	Social and community activities, health habits, diet exercise, vegetable intake	Document reviews , observations, interviews, survey (self-report of 1/2c serving of vegetables in past 24hours, and agree or disagree with statement 'in the past 4 months I have eaten a balanced diet most days from the Food Pyramid'	Gardener's reported consuming 11.1 vegetable servings (1/2 cup each) in the previous 24 h than comparison participants (4.5 vegetable servings) Gardeners indicated they had eaten a balanced diet significantly more often than comparison participants. 3.26 vs 2.27 on a 4 point scale ranging from strongly disagree=0 to strongly agree = 4.
Johnston et al. 2006	USA, WA	First year gardeners (n=29) second year gardeners (n=12)	Cross-sectional survey	No specifics provided	No specifics provided	More than half of gardeners reported eating more fruit and vegetables 81% of respondents reported using the garden to stretch dollars. All second-year gardeners reported perceived healthier lifestyles due to gardening

Adapted from L.A. McCormack, M.N. Laska, N.I. Larson and M. Story (2010)

2.2 Research design

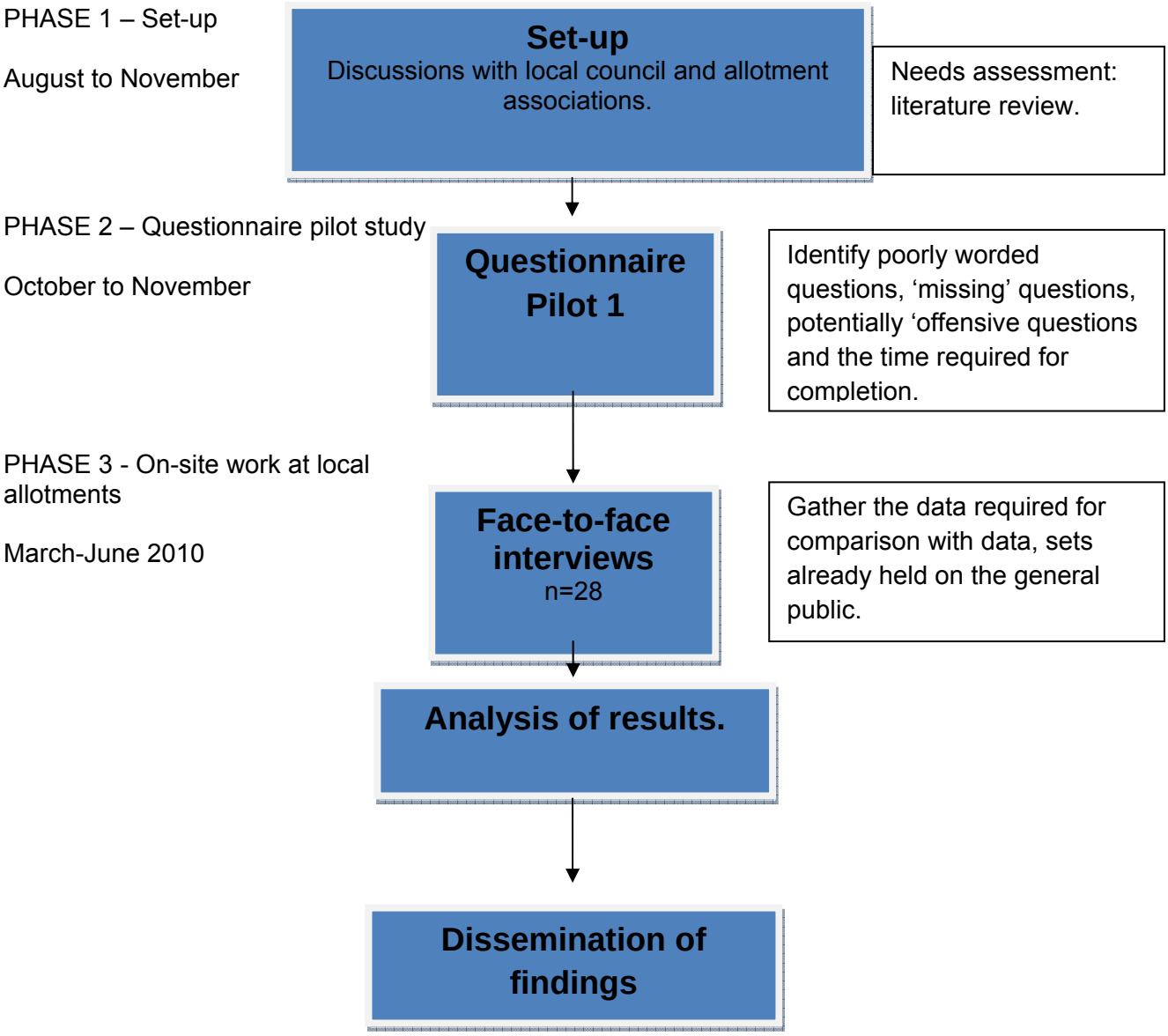


Figure 22 Diagrammatic view of the study design

2.3 Population sample and sample size estimation

This research project was carried out at community level, with participant recruitment taking place in two wards of Stockport (North Heatons and South Reddish).

Figure 23 - Map showing obesity levels of primary school pupils in Stockport

Face-to-face (one-to-one) interviews were taken with participants on several days during the period of March 2010- June 2010 in both locations.

Figure 24 Face-to-face interviews taking place at Whitehill allotment.

The interviews were structured and followed a set questionnaire, either interviewer completed or self-administered. Participants were only required to participate once. The basis of the questionnaire was quantitative research, with the occasionally qualitative question to add further insight in particular areas.

2.4 Sample Size

Sample size was estimated using a power calculation in consultation with a statistician (Mike Morris University of Chester) and based on data from British Heart Foundation Statistics Booklet [BHF] (2006) according to the statistical tests that will be performed and the expected values required in these tests. The effect size for the caclulation was obtained from previous work, which in this case is the average increase in fruit and vegetable consumption and was determined by Alamio et al. (2008) to be 1.4 times higher. The average fruit and vegetable consumption for Great Britain is 2.7 portions / day (Department of Health, 2004) with a standard deviation of 1.7 portions. This produces an effect size of 0.718. The significance level that will be used in this study will be 0.05, which means that there is a 95% chance that the result is real and not due to chance. The power used for this study will be 95%, which means that there is an 95% chance that a true difference will be detected. These figures were inserted into nQuery advisor software, which calculated a total sample size of 28 subjects (see **Appendix 5**).

2.5 Participant recruitment

Sample participants were recruited from locations within the Metropolitan Borough of Stockport, namely the two wards of South Reddish and North Heaton. Advertisements **(Appendix 1**) were placed in the local library, and on allotment noticed boards and discussed at the quarterly meeting of Stockport Metropolitan Allotment Garden Association (SMAGA).

Figure 25 The notice board at Whitehill Allotment.

Sampling was defined geographically, consisting of all members of the Priestnall Allotment Society and the Whitehill Allotment Society. All participants were recruited via convenience sampling until a total of 14 participants had been achieved at each allotment site. Permissions from both Allotment Societies were obtained and can be found in **Appendix 4**.

Both male and female volunteers were recruited across a range of ages,from 18 and above, to encorporate a complete demographic. Participants were able to give either verbal or written consent and had the ability to write or speak English and were therefore eligible to participate in the study. It was assumed that persons under the age of 18 were unlikely to be eligible for allotment ownership. Non- smokers were also excluded, as were persons of ill health and vegetarians, via the use of a pre-screening questionnaire (**Appendix 1**). In a recent study by Morabia, Curtin and Bernstein (1999) the effect of smoking on diet was evaluated and it was discovered that smokers had a less healthy diet than non smokers, consuming less carbohydrate, specifically fruit and vegetables. It is also well documented that cigarette smoking affects appetite. (Klesges, Meyers, Klesges, & La Vasque (1989) and Pomerleau , Ehrlich , Tate, Marks, Flessiand & Pomerleau (1993)). It should be noted that it was decided not to take the

height and weight estimates on the pre-screening questionnaire, as this may have affected the response rate of the questionnaire.

Ethical approval for the research was sought and gained from the University Of Chester Faculty Of Applied Health and Sciences' Research Ethics Committee (**Appendix 5**).

2.6 Questionnaire Design

The questionnaire (**Appendix 3**) has been devised to cover the most significant perceived health aspects of allotment 'ownership' linked to climate change awareness.

The questionnaire contained 4 sections. Section 1 Demographics, section 2 Allotment use and Climate change perceptions.

Section 3 was taken from a previous study (Thompson et al. 2000) and was validated in this study.

Section 4 on Physical activity levels was taken from the International Physical Activity Questionnaire [IPAQ] (2002)

A table detailing the rationale for the questionnaire design can be found in **Appendix 3** and lists the questions, the reasons for them and the supporting research.

The questionnaire as a whole was piloted to evaluate its use on this target sample and the results produced questionnaire version 2 (**Appendix 2)**

2.6.1 Pilot Study

For a questionnaire to be an effective research tool the respondent must be able to read and understand the question as the writer intended (Brace, 2008).The

questionnaire being used was not validated and therefore before data collection began it was piloted on a group of 6 individuals. For ease, this group was a convenience sample of individuals with allotments or home growing facilities, who were known to the researcher. The piloted questionnaire can be found in **Appendix 2** . The details of the resultant questions asked in the pilot study, such as 'How long did it take you to complete the questionnaire?', 'Were any of the questions ambiguous or unclear?' can also be found in **Appendix 2**.

Observations, interviews and questionnaires, have the potential to be intrusive, and provoke anxiety or stress (Saunders, Lewis and Thornhill , 2007) , however none of the participants classed any of the questions as being too intrusive. Based on the findings of the pilot study (**Appendix 2**), the questionnaire was slightly redesigned and questions were edited and in some cases added. The results were also used to assist in the writing of the PIS (**Appendix 1**).

The pilot study indicated that the completion time of the questionnaire was approximately 20 minutes.

3.6.2 Questionnaire Rationale

The questionnaire is divided into four sections, section A being demographic information. An evaluation of all the questions asked can be found in **Appendix 3.** The majority of the questions are quantitive, and require either dichotomous or closed-ended questions with one response. Some questions are multiple choice and in the form of 'tick all that apply'. Where a response is not suitable an 'other' box is supplied and respondents are required to specify their answer in the box supplied.

Section B details quesions based on allotment use and climate change factors. Quesitions were based on questionnaires carried out by Edinburgh Council (2007) and also Bisgrove and Hadley (2002).

Section C of the questionnaire covers the consumption of fruit and vegetables, both currently and retrospectively.

Fruit and vegetable intake was measured using 8 questionnaire items to assess frequency (per day, week, month, and year) of intake of fruit juice, other fruit, fried and non-fried potatoes and other vegetables. These questions were validated by Thompson et al. (2000) as a screener tool for fruit and vegetable consumption. A summary scale of frequency of intake of all fruits and vegetables was used to create a variable measuring fruit and vegetable intake per day. Although not as accurate as a FFQ, screeners such as this one provide a dietary instrument that is easy to administer and process when resources and purposes are more limited (Thompson et al. 2000). The screener is similar to the one used by Alaimo et al. (2008). where a positive association was seen.

The physical activity section of the questionnaire (Section D) is taken from the International Physical Activity Quesitonnaire ,(IPAQ) Short Form (2002) and answers will be analysed using the corresponding data processing guide.(IPAQ, 2005) and will produce results in MET* minutes per day.[2]

The IPAQ short form asks about three specific types of activity undertaken, walking, moderate-intensity activities and vigorous-intensity activities.The items in the short IPAQ form were structured to provide separate scores on walking, moderate-intensity and vigorous-intensity activity. Computation of the total score for the short form requires summation of the duration (in minutes) and frequency (days) of walking, moderate-intensity and vigorous-intensity activities. In addition to this quesitions 1 and 9 detail the participants views on allotment ownership and physical activity.

[2] **Metabolic equivalents (METs)** are useful units when recommending exercise. By definition, 1 MET is the amount of oxygen consumed at rest or about 3.5 mL/kg/min.

Allotments owners awareness and preparedness for climate change will be evaluated in a series of questions designed to give indications of their thoughts on climate change and the issues it brings with it. This will take the form of their own personal response to climate change and whether they themselves can do anything about their own impact on the climate, by lowering their carbon footprint. Questions in this section are a mixture of thoughts on climate change and participants current activities which have an effect on climate change issues, i.e. CO_2 emmisons, food miles and carbon footprint. For some participants their actions are a conscious effort to impact on personal climate change effects and for others these actions are subconscious but by asking the questions the participant's awareness will increase.

Table 4 Rationale for the questionnaire design.

Question	Rationale	Study adapted from
Section A Demographics		
1. Age ranges	Age ranges picked to correspond to Stockport JNSA(2007)	
2. Gender	To adjust for sex, fruit and veg consumption varies with gender	
3. Ethnic background	Fruit and vegetable consumption varies with ethnicity. Allotment owner demographics important	
4. Living Arrangements		
5. Residence type		
6. Education level		
7. Employment status		
Section B –Allotment Information		Edinburgh Council, (2007)
1. Length of time plot held	Important factor to determine inclusion criteria and effect of time on actions	
2. Frequency of attending	Frequency of attending will affect physical activity levels	
3. Hours at each visit	Time spent at each visit may indicate physical activity levels, dependant on how time spent	
4. Alone or with family	Indicates, knock on effect to children and family members health	
5. Travel to plot	Is this also providing activity	
6. Reasons for ownership	Qualitative indication of ownership , to evaluate if health is a reason	
7. Crops grown	To provide information on crops currently being grown in current climate conditions	
8. Also purchase	Can families be self sufficient with an allotment or is it only a 'top-up'	
9. Proportions grown	To what extent has the allotment taken over as F & V provider	
10. Where purchase from	Provides information on whether thinking about locally sourced foods	

Climate Change 11. Climate change factors 12. Will it affect allotments 13. How soon 14. How will it affect 15. Crops plan to grow 16. What new crops 17. What crops can't grow	Establishes perceptions of climate change	Bisgrove and Hadley (2002)
Section C – Fruit and Vegetable Consumption. 1. Orange or Grapefruit in last month 2. Other fruit juice in last month 3. French fries or fried potatoes 4. Baked, boiled or mash 5. Days a month, eating fruit 6. No. of portions of fruit 7. Days a month eating veg. 8. No. of portions of veg. 9. Has intake altered, since allotment 10. How many portions a day?	Establishes a quantity of fruit and vegetables consumed in a monthly period in portions per day.	Thompson et al.(2000)
Section D- Physical Activity	Questions determine the physical activity over a period of a week and whether a difference is noted before and after allotment 'ownership'.	IPAC (2002)

2.7 Procedures

It was originally proposed that a desk was manned at allotment entrances on pre-advertised days, to provide a contact point for allotment holders to volunteer and obtain information, however in practise this was unsuccesful in obtaining recruits and a more direct, face-to-face approach was required.

The study was advertised on both sites and people were approached with regard to participating in the study.

Information on the study was discussed with potential participants and participant information sheets and consent forms were given out and written consent was obtained. A pre-screen questionnaire was undertaken with consenting participants to ensure the relevant criteria were met. (**Appendix 2)** This took approximately 5-10 minutes.

Arrangements could then be made for opportunities to undertake the questionnaires via an interview, taking a maximum of 30 minutes. Some participants chose to take the questionnaire away to look through it at their own convenience.

Due to vandalism, allotment sites are kept locked and access can only be gained via previous arrangement with the chair of each allotment society.

Priestnall allotment

Participants were interviewed on Sundays between 10am and 12.00am from April 2010 to June 2010.

Whitehill

Participants were interviewed on Saturdays and Sundays between 10am and 2 pm and also on one pre-arranged Wednesday, between April and June 2010.

A choice of seed packets was offered to consenting participants as a ‘thankyou’ for participating.

2.8 Data Analysis

The participants will act as their own control for certain questions by answering in a retrospective manner, comparing present behaviours with those prior to allotment 'ownership'. Direct comparisons will also be made between the allotment holders and data held on the general public, such as the NDNS and ONS and Department of Health, 2004 'Choosing health;making healthy choices easier.'

Quantitiative data on fruit and vegetable consumption (portions / day) and physical activity (days/hours/minutes and activity level) will be generated by the questionnaire and will be analysed using descriptive statistics (mean, mode, frequency, standard deviation etc.)

The primary hypothesis on fruit and vegetable consumption with be compared to values obtained from the DOH, 2004 and data for Stockport specifically, Stockport Health Survey, 2006. Distribution of the data will be tested followed using the KS test for normality and then by the conduction of a one tailed sample T-test to determine significant differences.

Cross tabulations and frequencies will be split by age, sex, ethnicity and allotment site to investigate both the primary and secondary hypotheses.

All quantitative data will be analysed using SPSS version 17 for Windows and the significance set at 0.05.

Some qualitative data will be obtained in the form of participant’s opinions on allotment 'ownership' and climate change and will be reported as such. Participant’s responses will be collated into the thematic data. The grouped responses will be

coded. Quantitative averages (mean, median and range) will then be used as a simple overview of the responses.

2.9 Ethics

Ethical approval was obtained from the University of Chester Faculty of Biological Sciences ethical Research Committee (**Appendix 4**)

To gain approval the credibility and benefits of the research had to be demonstrated and set against the potential harm to research participants and measures put in place to limit this potential harm.

Although this study was deemed to be low risk, any research involving the interviewing of participants carries a potential for risk. This was minimised by following set procedures, such as, ensuring voluntary participation, informed consent to participate, data protection procedures, maintaining anonymity and being aware of participants' potential sensitivities throughout.

Informed consent took the form of a Participant Information Sheet (PIS) which was supplied to the potential participant, prior to written consent being taken. Included in this document were the reasons for the study, the methods that would be used and what would be expected as a participant. The voluntary nature of participation and the right to withdraw from the study were also expressed. Also outlined were the methods of data protection and any potential risk to the participant.

The Participant information sheet for this study can be found in **Appendix 1.**

2.9.1 Other ethical considerations

It was decided that the impact on the environment should be minimised during this study and where possible measures were taken to enforce this. The effect of

reproducing paper copies of PIS, Consent forms, and questionnaires was minimised by reproducing only enough copies as was required and by printing double sided. When an extra copy was required through participant loss, it was suggested that an email copy could be supplied.

When possible the researcher walked to the allotment sites and minimised visits and when walking was not possible, by grouping interviews thus reducing her own carbon footprint.

Chapter 3 – RESULTS

A summary of the research findings is presented in this section. The results are ordered to answer the research hypotheses that were suggested in the introduction.

3.1 Pilot Questionnaire

The results of the pilot questionnaire were used to restructure the final questionnaire and to define any areas of unsuitability. The pilot also allowed timings to be confirmed. The results of the pilot are provided in **Table 5**.

Table 5 Pilot questionnaire results

Question		Participant response					Combined results
		1	2	3	4	5	
1	Was the participant information sheet clear?	Yes	Yes	Yes	Yes	Yes	Yes
2	How long did the questionnaire take to complete?	20 mins	15 mins	20 mins	10 mins	20 mins	17 mins
3	Did you find the instructions easy to follow?	Yes	Yes	Yes	Yes	Yes	Yes
4	Did you object to answering any of the questions?	No	No	No	No	No	No
5	Were any of the questions ambiguous or unclear?	No	Yes	Yes	Yes	Yes	Yes
6	If so which ones?	None	B3, B5,B8 D4, D 14	B9, B14,B15	B9, C9, D13 B14 B15	B8	
7	Have any major topics been omitted, in your opinion?	Competitive sport	No	Which food outlets	Cost of allotments		
8	Was the layout clear and aesthetically pleasing?	Ok	Yes	Yes	Yes	Yes	
9	Any further comments?	Very interesting piece of work	I look forward to hearing the results	none	Well grouped questions	The results will be seasonal	

All data was collected during the interviews with 28 participants completing the voluntary questionnaires, 14 from Priestnall Allotment and 14 from Whitehill Allotment.

3.2 SECTION A: Demographics

3.2.1. Participants

The mean age range of the participants falls between the ranges of 35-49 and 50-64, with the modal age range being 35-49.

Table 6 Participant age ranges

	Priestnall	Whitehill
18-24	0	0
25-34	0	1
35-49	9	4
50-64	1	7
65+	3	2
	n=14	n=14

The male to female ratio of the participants was 42.9: 57.1

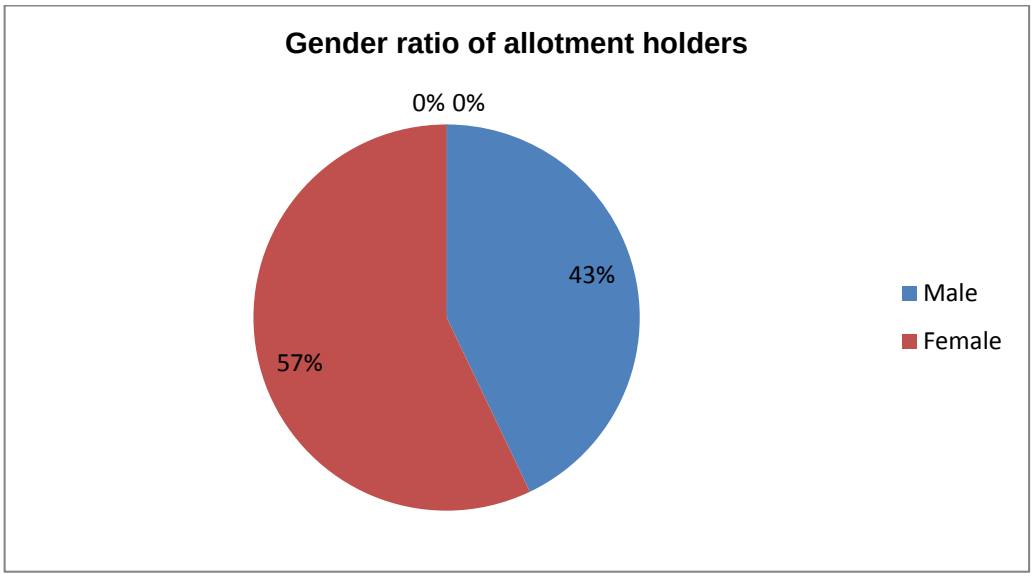


Figure 26 Gender of plot holders

The ethnic diversity was not wide spread with 96.4 percent (n=27) of the participants being White and 3.6 percent (n=1) being Chinese in origin.

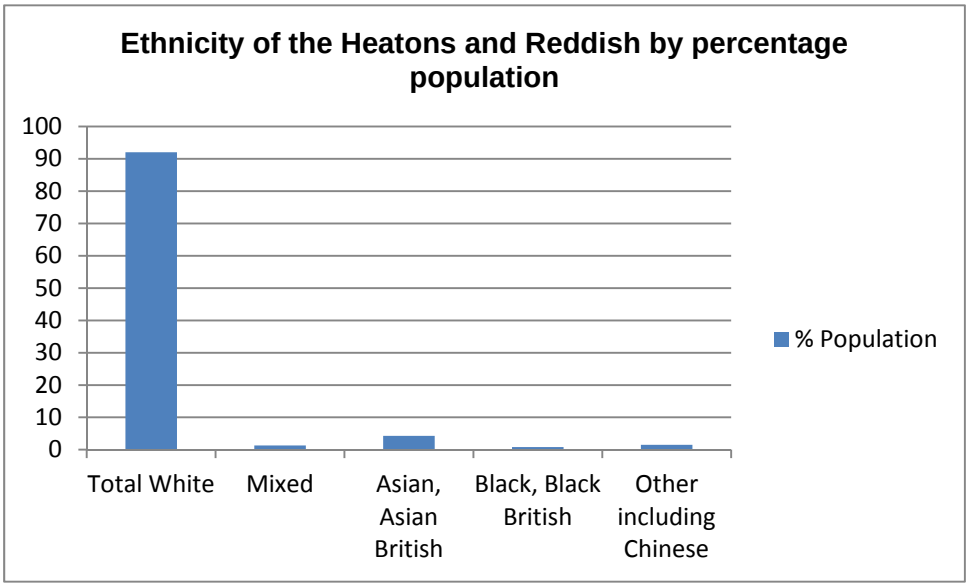


Figure 27 The Ethnicity of the residents of the Heatons and Reddish by percentage population. Source Interactive Stockport.2010

3.2.2 Socio-Economic data

3.2.2.1. Living arrangements

The modal living arrangement was 'Living with partner' and this was true for both allotment locations.

Table 7 Participant living arrangements

	Priestnall	Whitehill
Live alone	0	1
Live in a shared house	0	0
Live with parents	0	0
Live with partner	9	8
Living with dependent children	1	0
Live with partner & dependent children	4	5
other	0	0

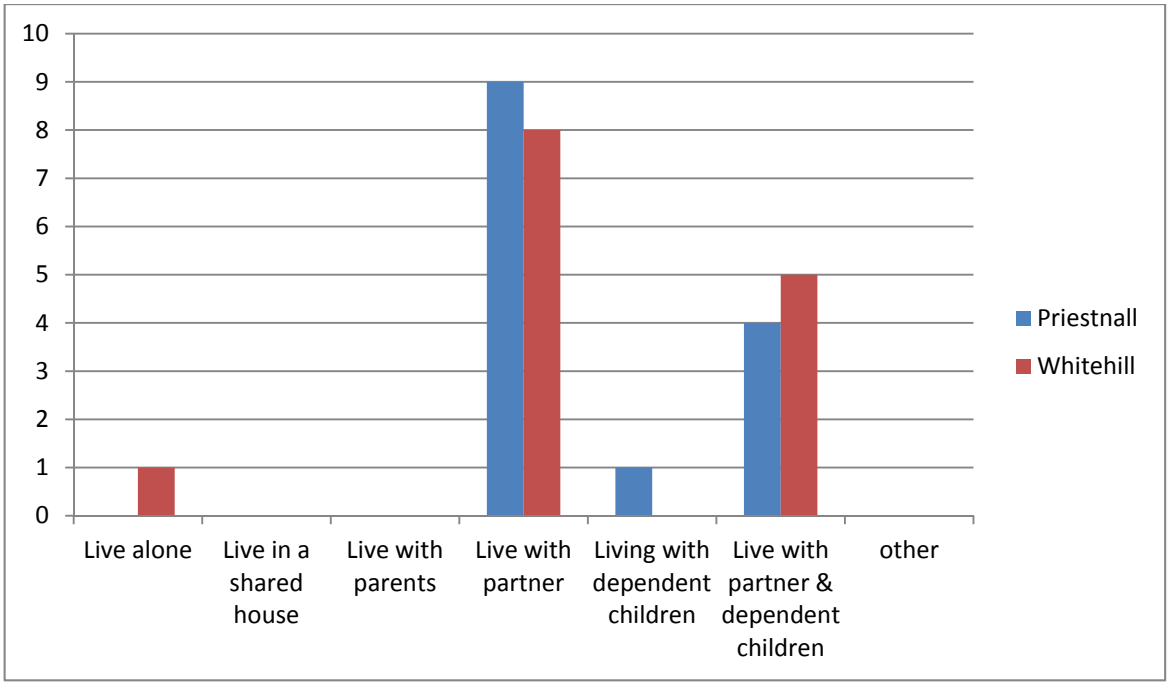


Figure 28 Participant living arrangements split by allotment site

The majority of participants owned their own home 92.9% (n=26)

Table 8 Participants owning or renting their homes by allotment site

	Priestnall	Whitehill
Own	14	12
Rent	0	2

3.2.2.2 Residence type

In the Priestnall area the majority of participants live in a semi-detached residence, whereas there is a more even spread in the Whitehill area with a higher number of the participants living in terraced housing and semi-detached.

Table 9 Participants' residence type by allotment site

	Priestnall	Whitehill
Apartment/flat	1	1
Terraced	3	7
Semi-detached	9	6
Detached	1	

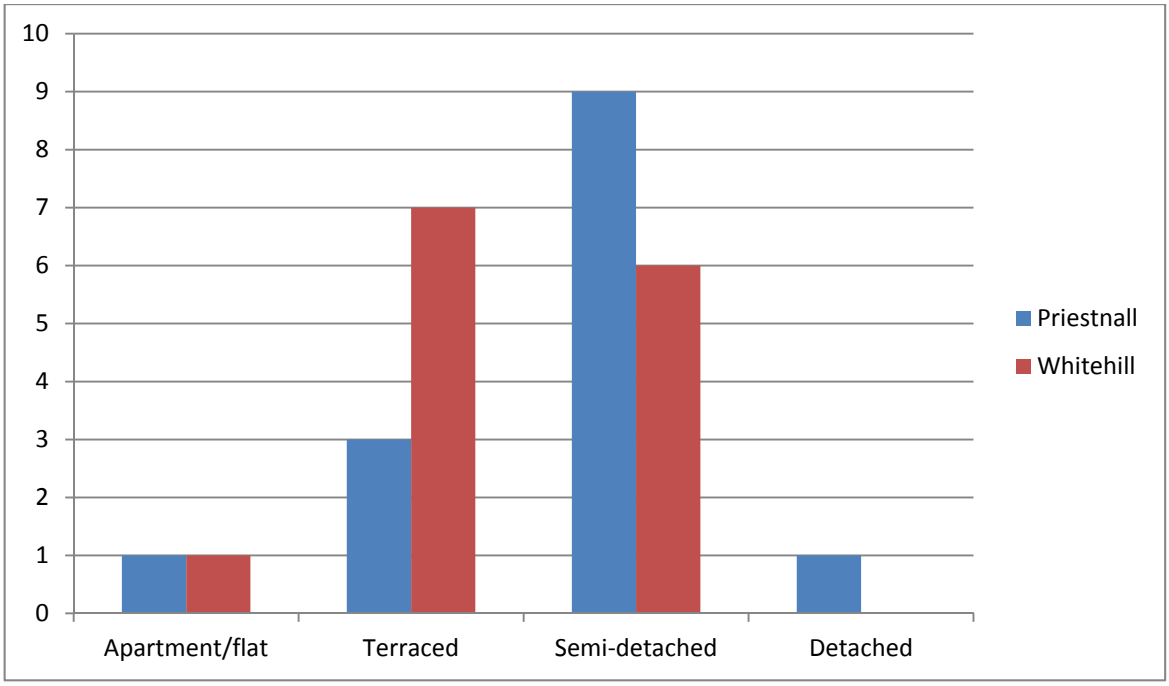


Figure 29 Participants' residence type by allotment site

3.2.2.3 Education

A notable difference was observed between the educational levels of the participants at the two allotments sites, of the participants interviewed at Priestnall Allotment site 42.9% had a first degree and 57.1% a Masters qualification, whereas the findings covered a wider range of educational levels at the Whitehill allotment site, with the modal educational level being 'No specific qualification' and the median level being between GCSE and A-level.

Table 10 Participants education levels by Allotment site.

	Priestnall	Whitehill
None	0	4
GCSE(D to G)	0	2
GCSE (C to A)	0	1
A level or equivalent	0	3
First degree	6	3
Masters	8	1
Doctorate	0	0
	n=14	n=14
Mode	Masters	None
Median	Masters	GCSE-A-level

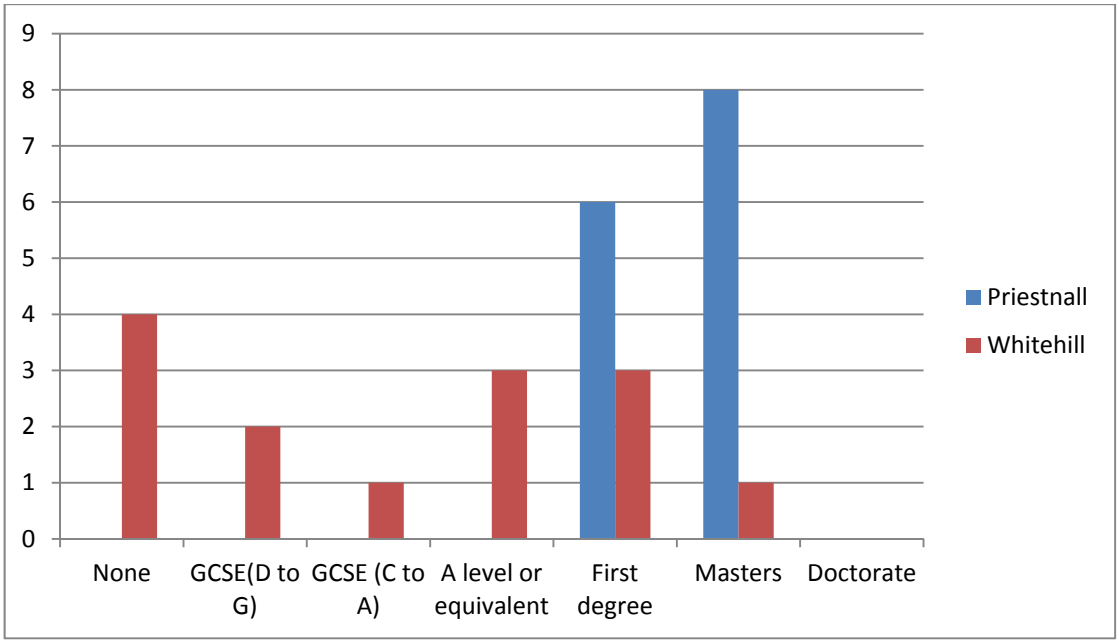


Figure 30 Educational levels of participants by allotment site.

3.2.3.4 Employment

The majority of people at the Priestnall allotment site are employed, whereas there is a more even split at the Whitehill site. It should be noted unemployed also includes retired.

Table 11 Participant employment by allotment site

	Priestnall	Whitehill
Yes	12	8
No	2	6

3.3 SECTION B - Allotment Information

3.3.1 Length of time plot held

Table 12 The length of time the participants had held an allotment plot.

	Priestnall	Whitehill
Less than 6 months	1	1
6-12 months	1	2
1-2 years	1	1
Over 2 years	11	10

The mean length of time allotment holders had 'owned' a plot was over 2 years, with 71.4% of the participants having held their plot for 2 years or over.

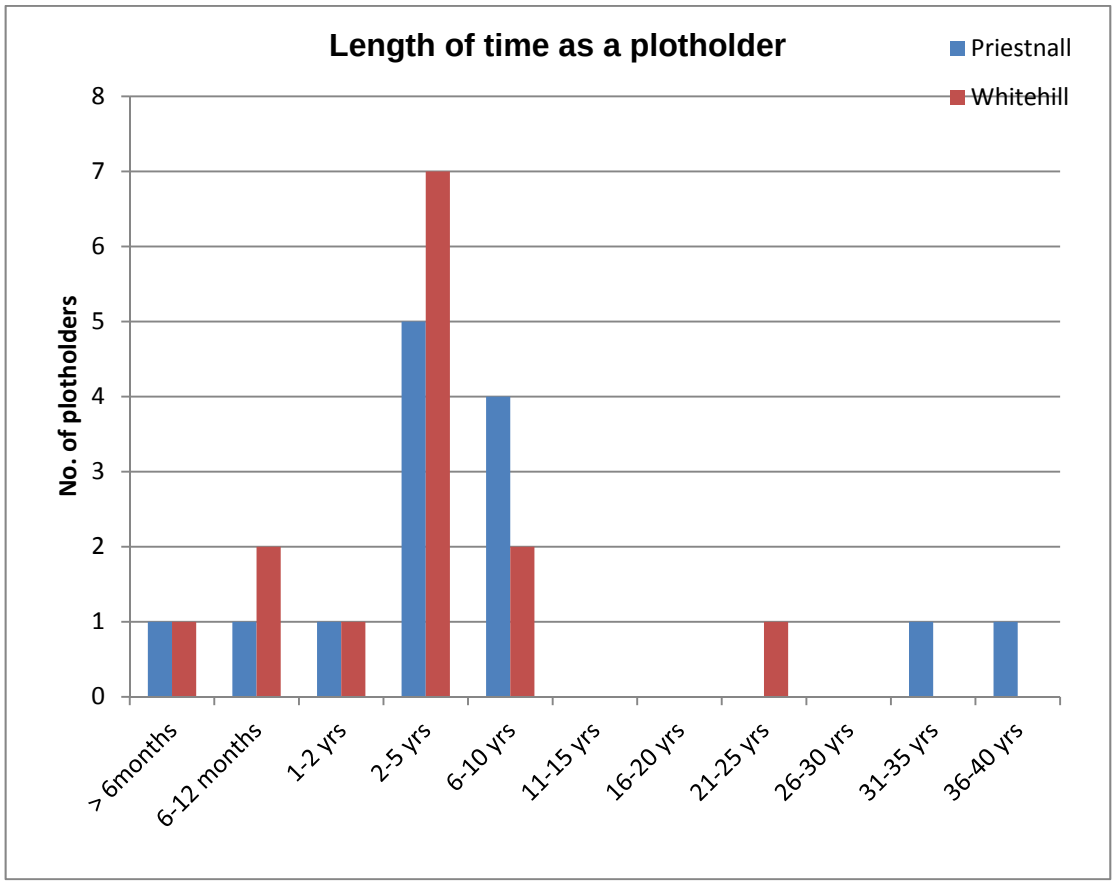


Figure 31 Total length of time plot held for.

Some participants had been plot holders for over 30 years.

3.3.2 Plot attendance

The majority (46.4%) of participants attend the allotment twice a week.

Table 13 Frequency of plot attendance.

	Priestnall	Whitehill
Daily	1	3
Every other day	1	6
Twice/week	8	5
Once/week	2	0
Fortnightly	2	0
Monthly	0	0
Less than once/month	0	0

The mean time spent at the allotment site per visit in the spring and summer months is 3.36 hours.

Table 14 Time spent at the allotment plot in the spring/summer

Hours	Priestnall	Whitehill
1	0	1
2	4	4
3	5	3
4	2	4
5	1	1
6	2	1

The mean time spent per visit at the allotment site per visit in the autumn and winter months is 2.07 hours.

Table 15 Time spent at the allotment plot autumn/ winter

Hours	Priestnall	Whitehill
1	6	6
2	6	5
3	1	1
4	1	2
5	0	0
6	0	0

3.3.3. Alone or family member

The majority of participants attend the plot alone (57.1%), whereas 42.9% are attending with family members.

Table 16 Participant attendance by who is attending.

	Priestnall	Whitehill
Alone	10	6
With family member	4	8

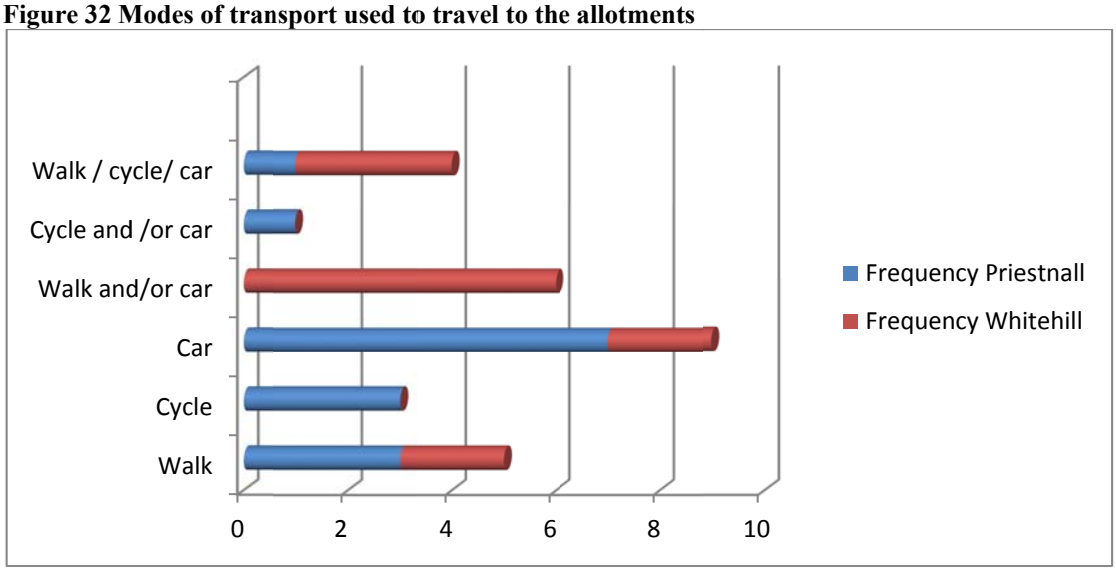
3.3.4. Travel to the allotment

Various modes of transport (and combinations thereof) are used to travel to the allotment sites. The majority of participants are using a car or a combination of a car and walking **Figure 32.**

Table 17 Modes of transport and combinations of transport used to get to the allotment.

Transport		Frequency Priestnall	Frequency Whitehill	Frequency
Walk	A	3	2	5
Cycle	B	3	0	3
Car	C	7	2	9
Walk and/or car	AC	0	6	6
Cycle and /or car	BC	1	0	1
Walk / cycle/ car	ABC	1	3	4
	Total			n=28

Figure 32 Modes of transport used to travel to the allotments



3.3.5. Reasons for plot ownership

The reasons for plot ownership are multi-faceted and are depicted in the spider diagram below **Figure 33.** Green areas depict environmental reasons, Red areas are health reasons, Blue is physical activity and orange is financial. All participants expressed more than one reason for plot ownership. The most commonly suggested reasons were that 'Fresh food tastes better' (n=12) and 'I want to know what is in my food / that it is organically grown' (n=12).

Figure 33 A representation of participants' reasons for plot 'ownership'

3.3.6. Allotment proportion of fruit and vegetables

The majority of participants stated that 50% of the fruit and vegetables that they consume are produced by the allotment. Participants who had 'owned' a plot for 6 months or less (n=2) were unable to answer this question due to them not having completed a growing season and /or produced any crops.

Table 18 Proportion of fruit and vegetables consumed that are produced on the allotment.

	Priestnall	Whitehill
All	0	0
75%	2	2
50%	5	10
25%	4	2

*0% New owners so no produce so far (n=2)

3.3.7 Are fruit and vegetables purchased in addition to the allotment produce?

No participants are totally reliant on the allotment for producing their fruit and vegetables and they are all supplementing their intake with purchased fruit and vegetables. The most frequently used outlet for additional fruit and vegetable purchases was the supermarket, with 60.7% of participants using it. A summary of these results can be found in **Table 19.**

Table 19 Sources of supplementary fruit and vegetables.

	Frequency	Percent
Supermarket	17	60.7
Veg. Box Scheme	1	3.6
Other	3	10.7
Supermarket + Farmers market	2	7.1
Supermarket + other*	4	14.3
Supermarket+Farmers market + other*	1	3.6
Total	28	100.0

*Where other is quoted, participants used the local greengrocers shop.

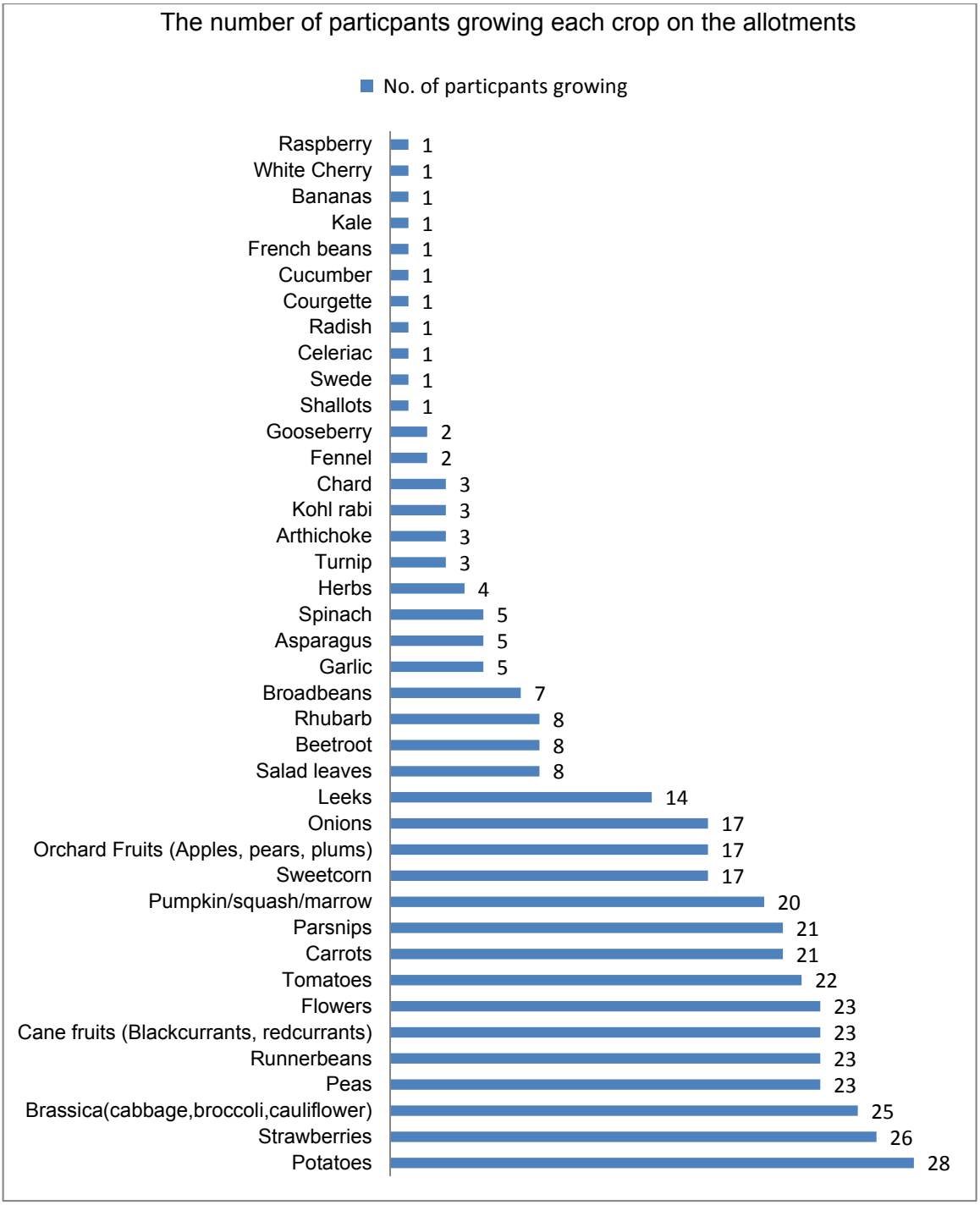


Figure 34 Crops grown on the allotments

Figure 34 represents the crops grown by the allotment holders and the number of participants growing each crop. Every participant reported growing potatoes and the majority were also growing strawberries. Less frequently observed crops were bananas (**Figure 35**), raspberries and white cherries.

Figure 35 A banana plant being grown on an allotment

3.4 Climate change results:

Participants were asked which would be more frequently observed with Climate change. n=28 **Table 20** outlines the participants perceptions of what factors may affect climate change. 67.9% of participants thought that rain would be more frequently observed and 57.1% that drought and increased temperatures would also be observed.

Table 20 Participant perceptions of climate change and factors involved.

	Yes	No	% Yes	% No
Snow	6	22	21.4	78.6
Wind	3	25	10.7	89.3
Rain	19	9	67.9	32.1
Drought	16	12	57.1	42.9
Lightning	5	23	17.9	82.1
Decreased Seasonality	13	15	46.4	53.6
Increase in Temp	16	12	57.1	42.9
Decrease in Temp.	5	23	17.9	82.1

3.4.1. Will climate change affect the use of allotments?

61% of participants (n=28) thought that allotments would be affected by climate change.

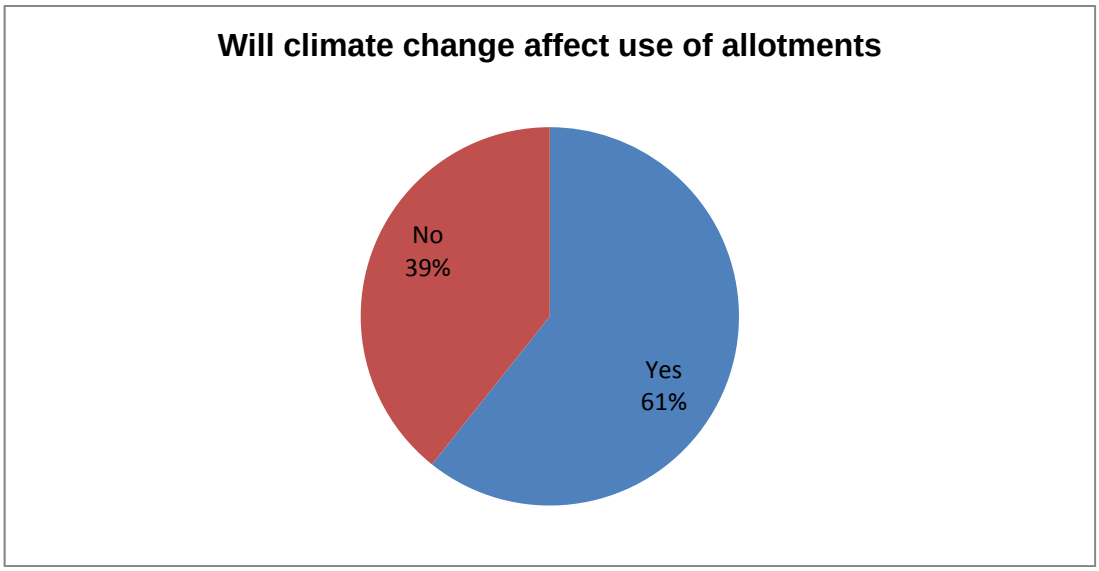


Figure 36 Participants views on whether allotments will be affected by climate change.

3.4.2 If yes how soon will the effect be felt?

If participants thought that allotment would be affected by climate change (n=18) they were asked how soon they thought effects would be felt. 33.3% perceived that the change was already being felt and another 33.3% indicated that there would be no change felt for another 20 years.

Table 21 Participants perceptions of how soon climate change will occur

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-1 yrs	6	21.4	33.3	33.3
	6-10 yrs	2	7.1	11.1	44.4
	20 + years	6	21.4	33.3	77.8
	Not in my lifetime	3	10.7	16.7	94.4
	Other	1	3.6	5.6	100.0
	Total	18	64.3	100.0	
Missing	System	10	35.7		

Table 22 Participants perceptions of the effect of climate change on allotments.

	Yes	No	% Yes	% No
Drought	9	10	47.4	52.6
Increased insects/bugs	10	9	52.6	47.6
Change of crops	15	4	78.9	21.1
Lightning	4	15	21.1	78.9
Increased temperature	10	9	52.6	47.4
Flooding	10	9	52.6	47.4
Other*	3	16	15.8	84.2

Respondents n=19 out of the 28 total due to some not thinking Climate change would affect allotments.

*Where other was selected the participants suggested that there would be an increased variability.

Table 22 outlines the participants' perceptions of the potential effects that climate change could cause and the one that they perceive may be observed to have an effect on allotments. 78.9% of participants think that a change of crops may be necessary with a changing climate and 52.6% that there will be increased temperatures, insects and bugs and flooding.

When asked if they would grow different crops to account for the changing climate 61.1% of the participants (n=18) said that they **would not.**

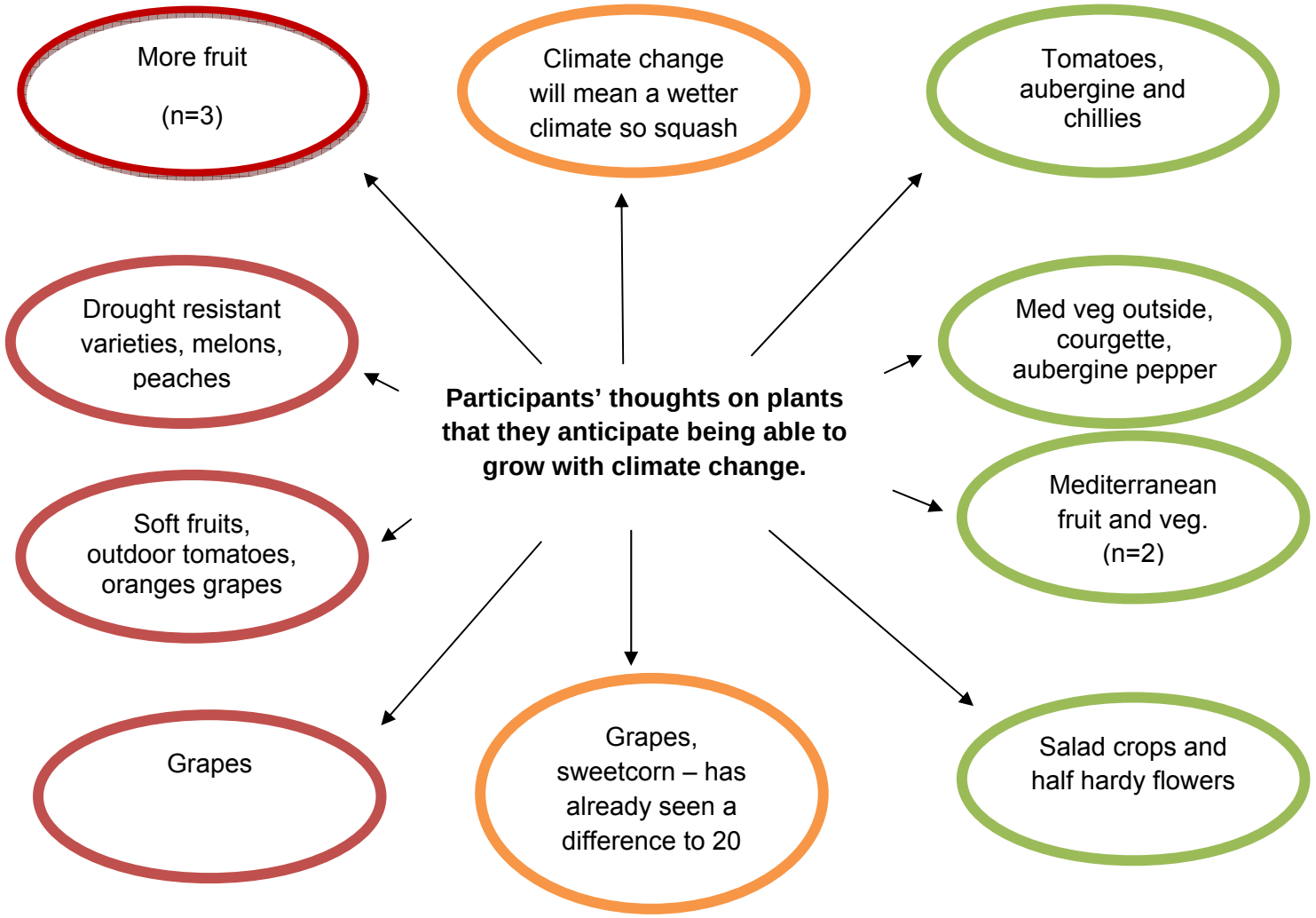


Figure 37 Participants' views on plants they anticipate being able to grow with climate change.

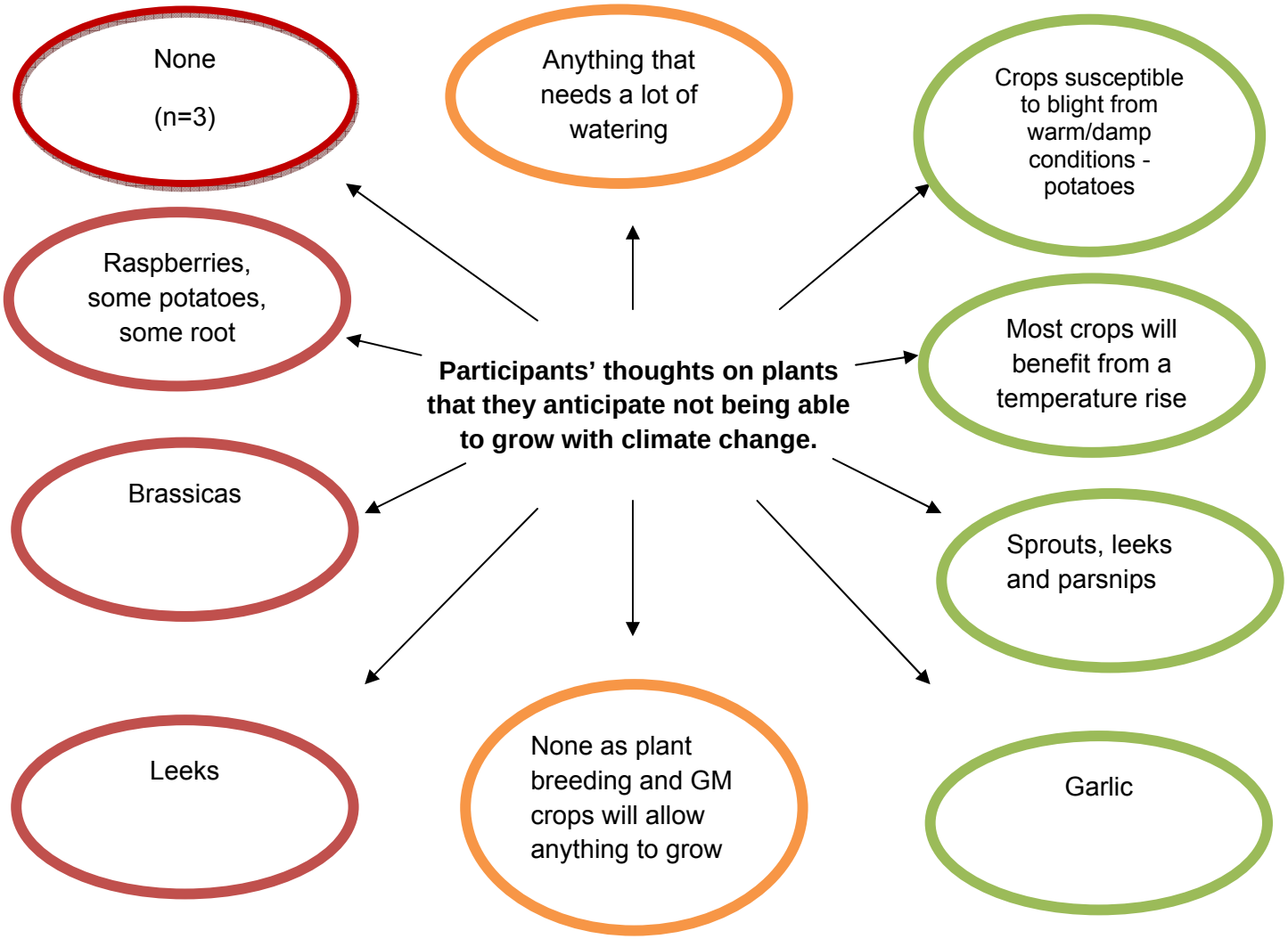


Figure 38 Participants' views of crops they do not anticipate being able to grow with climate change

3.5. SECTION C: Fruit and Vegetable consumption

3.5.1 Frequency of consumption in the last month.

Table 23 Orange and Grapefruit juice

	Priestnall	Whitehill
Never	3	1
1-3 times last month	6	7
1-2 times/week	2	4
3-4 times /week	3	
5-6 times /week		
1 time / day		2
2 times/day		
More 3 times a day		

Orange and grapefruit juice was most frequently consumed 1-1 times in the last month. Only two people drank orange or grapefruit juice daily.

Table 24 Other juice

	Priestnall	Whitehill
Never	4	6
1-3 times last month	4	4
1-2 times/week		2
3-4 times /week	5	2
5-6 times /week		
1 time / day	1	
2 times/day		
More 3 times a day		

Never was the most frequently observed consumption for other fruit juices.

Table 25 French fries or fried potatoes

	Priestnall	Whitehill
Never	1	1
1-3 times last month	13	9
1-2 times/week		3
3-4 times /week		
5-6 times /week		
1 time / day		1
2 times/day		
More 3 times a day		

French fries were most commonly consumed 1-3 times in the last month

Table 26 Baked, boiled or mash

	Priestnall	Whitehill
Never		
1-3 times last month		1
1-2 times/week	8	8
3-4 times /week	6	3
5-6 times /week		
1 time / day		1
2 times/day		1
More 3 times a day		

Potatoes cooked by other methods were consumed mostly frequently once or twice a week.

Table 27 Days eating fruit as snack or meal

	Priestnall	Whitehill
Never		2
1-3 days last month		2
1-2 days/week	2	3
3-4 days /week	1	1
5-6 times /week	2	1
Every day	9	5

Table 28 No. of fruit portions consumed

	Priestnall	Whitehill
1 or less	1	7
2	7	3
3 or more	6	4

Most people consumed fruit daily (*n=14*), with the majority eating 2 portions.

Table 29 Days eating vegetables as meal or snack

	Priestnall	Whitehill
Never		
1-3 days last month		
1-2 days/week	1	1
3-4 days /week	1	3
5-6 times /week	1	2
Every day	11	8

Table 30 No. of portions

	Priestnall	Whitehill
1 or less		
2	5	8
3 or more	9	6

Most people consumed vegetable daily (*n=18*), with the majority eating 3 or more portions.

Table 31 Intake increased with allotment?

	Priestnall	Whitehill
Yes	10	8
No	4	6

The majority of participants (*n=18*) said that allotment ownership had increased their intake of fruit and vegetables.

Table 32 No of portions change

	Priestnall	Whitehill
1 or less	4	4
2	5	4
3 or more	1	

* will only contain results for those who think it has increased.

The most frequently observed increase was 2 portions per day.

In order to assess these results the frequencies of consumption had to be translated into daily frequencies. See table in **Appendix 5**

To determine the number of portions of fruit and vegetables the individual consumed the equation below was used:

Equation 1

$$E \text{ (Fruits and Veg.)} = ([N_{FG1}P_1 + N_{FG2}P_2 + \ldots + N_{FG7}P_7)$$

Where E is the portion

N_{FG} is the number of times per day the food item was consumed (daily frequency)

P_1 is the median portion size for that food group.

Table 33 Mean no. of portions of fruit and vegetables consumed by the U.K. population by age and gender.

	19-24	25-34	35-49	50-64	All	Target
Men	1.3	2.2	3.0	3.6	2.7	5
Women	1.8	2.4	2.9	3.8	2.9	5

*Source Department of Health (2004)

Mean daily portion intakes and standard errors for participants, both pre and post allotment ownerships for each of the demographics and the percentage of the

participants consuming five or more portions of fruit and vegetables daily are recorded in **Table 34**

Table 34 The mean number of portions of fruit and vegetables consumed pre and post plot ownership defined by demographic

Fruit and vegetable consumption by demographic							
		Pre plot		% consuming 5 or more p/d	Post plot		% consuming 5 or more p/d
Age	**n**	**Mean**	**(SE)**	**n=2**	**Mean (SE)**		**n=12**
25-34	1	3.1			4.1	.	
35-49	13	2.7	(1.8)		4.0	(1.9)	21.4
50-64	8	2.6	(2.4)	7.1	3.6	(2.1)	10.7
65+	6	3.1	(.7)		4.6	(1.3)	10.7
Gender							
Male	12	1.7	(1.4)		2.8	(1.4)	3.6
Female	16	3.6	(1.6)	7.1	4.9	(1.5)	39.3
Living arrangements							
Live alone	1	3.1			3.1		
Live with partner	17	3.1	(1.6)	3.6	4.4	(1.7)	32.1
Live with dependent children	1	4.7			6.7		3.6
Live with partner and dependents	8	2.1	(2.0)	3.6	3.1	(1.6)	7.1
other	1	.0			3.0		
Own or rent							
Own	26	2.8	(1.8)	7.1	4.1	(1.8)	42.9
Rent	2	2.7	(.5)		3.2	(1.2)	
House type							
Flat	2	3.6	(.8)		4.6	(2.2)	3.6
Terraced	10	1.9	(1.7)		3.0	(1.8)	10.7
Semi-detached	15	3.2	(1.8)	7.1	4.5	(1.6)	28.6
Detached	1	2.6			4.6		
Education							
None	4	2.0	(1.8)		2.8	(2.4)	3.6
GCSE (grade D to G)	1	.9			1.9		
GCSE (grade A to C)	2	.5	(1.0)		2.5	(1.0)	
A level or equivalent	3	1.9	(1.4)		2.9	(1.0)	
First degree	8	2.6	(1.8)		4.2	(1.7)	14.3
Masters Degree	10	4.0	(1.2)	7.1	5.1	(1.1)	25.0
Employment							
Yes	20	2.8	(1.9)	7.1	4.0	(1.7)	32.1
No	8	2.6	(1.3)		4.0	(1.9)	10.7

Prior to having an allotment 7.1% of the participants were consuming 5 or more portions of fruit and vegetables a day, whereas post allotment 42.9% are consuming 5 or more portions a day.

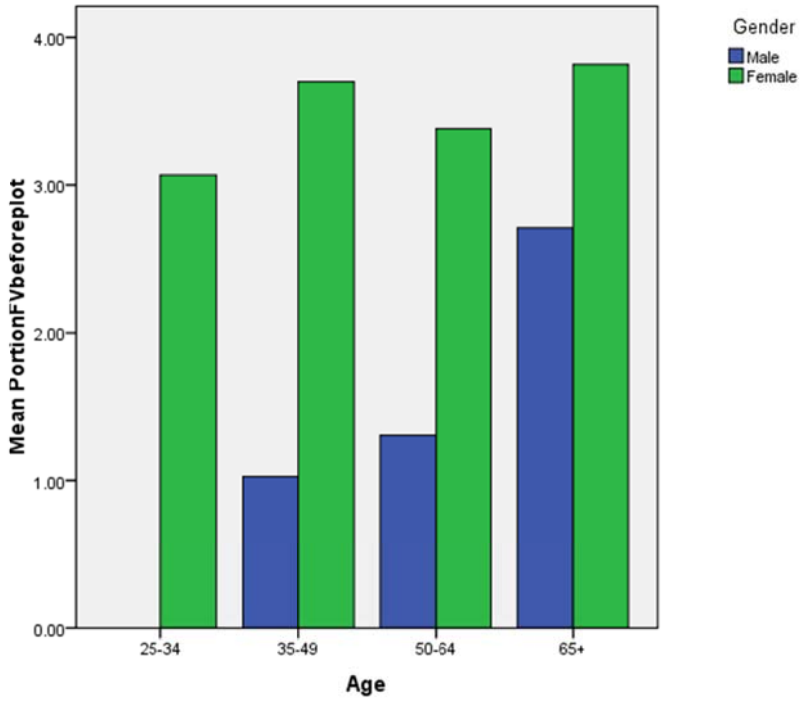


Figure 39 Mean fruit and vegetable consumption before allotment ownership by age and gender

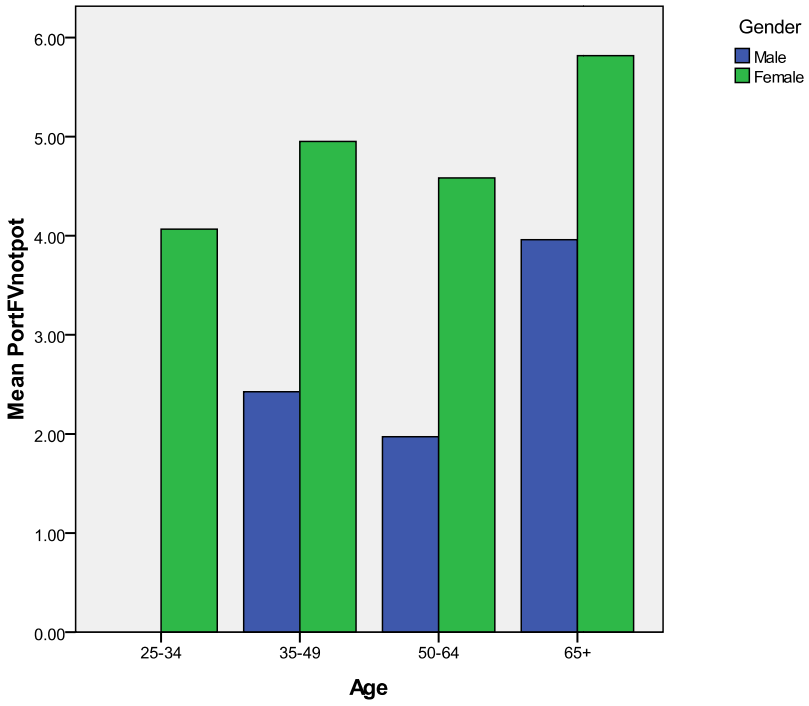


Figure 40 Mean fruit and vegetable consumption after allotment ownership by age and gender

3.4.2 Proportion of Participants achieving '5 –a day'

Prior to allotment ownership N=2 allotment holders were eating 5 or more fruit and vegetables a day, which equates to 7%. Both of these participants were female and aged 50-64.

3.4.2.1Current status as an allotment holder

Currently 12 participants are achieving 5 or more fruit and vegetable portions a day, which equates to 43%. The majority of the participants are women (n=11). The age ranges can be seen in **Table 35.**

Table 35 Age range of the allotment holders consuming 5 or more portions a day.

	Age			Total
	35-49	50-64	65+	
Total	6	3	3	12

Table 36 Mean portions consumed split by allotment site.

		Before		After	
	n	Mean	Std E	Mean	Std E
Priestnall	14	3.30	1.71	4.80	1.51
Whitehill	14	2.21	1.70	3.21	1.69

Participants from Priestnall allotments have a higher mean portion consumption than those at Whitehill allotments, however the consumption prior to allotment 'ownership' was also higher.

3.6. Normality

It was confirmed by a statistician (Colin Sinclair) that the data was continuous and n was approximately 30 that it could be assumed to be normal, thus allowing parametric tests to be used. This was confirmed by carrying out a test for normality.

The KS test for normality was performed on the fruit and vegetable consumption results and also the physical activity results.

Fruit and vegetable consumption prior to allotment ownerships Z=0.711, p= 0.693 and current fruit and vegetable consumption Z= 0.753, p= 0.622.

Physical activity levels prior to allotment ownership Z= 0.872, p= 0.433 and current physical activity levels Z= 1.120, p= 0.163.

The KS test verifies the probability of obtaining the results you got if the null hypothesis were actually true.

The use of parametric tests relies on the data being used to be normally distributed, however a non normal distribution does not necessarily mean heterogeneous data, but may simply be the nature of the construct being measured (Pallant, 2007)

3.7 Hypothesis One

Allotment holders consume significantly higher proportions of fruit and vegetables than the general public.

P_1= Allotment Holders

P_2= General Public

H_0= $P_1 < P_2$

Table 37 Mean Fruit and vegetable consumption

Condition	Gender	Age 19-24	Age 25-34	Age 35-49	Age 50-64	Age 65+	Average	Std. Dev.
General Public*	M	1.3	2.2	3.0	3.6		2.7	
	F	1.8	2.4	2.9	3.8		2.9	
Pre-Allotment	M		N=0	N=5 1.026	N=3 1.3	N=4 2.7	N=12 1.66	1.37
	F		N=1 3.07	N=8 3.7	N=5 3.38	N=2 3.81	N=16 3.57	1.58
Post Allotment	M		N=0	N=5 2.43	N=3 1.97	N=4 3.96	N=12 2.82	1.39
	F		N=1 4.06	N=8 4.95	N=5 4.58	N=2 5.81	N=16 4.89	1.50

* British Heart Foundation Statistics. (2005)

Mean values for fruit and vegetables by age and gender were compared to values for the general public.

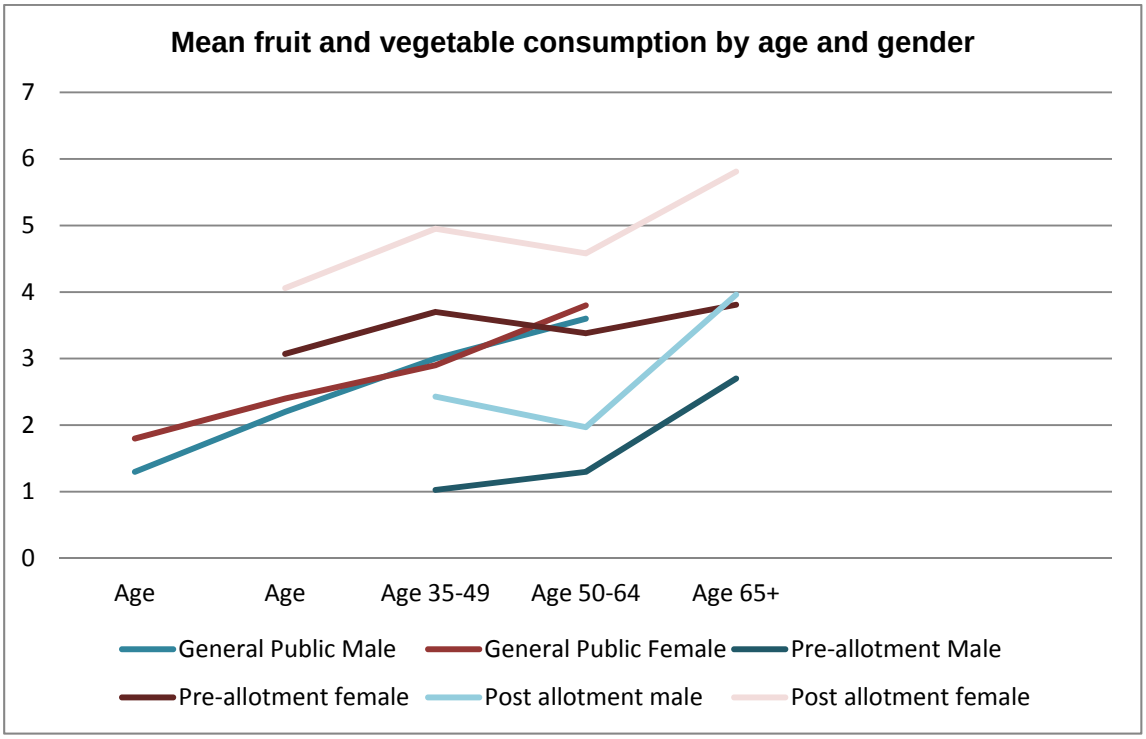


Figure 41 Comparison of mean fruit and vegetable consumption by age and gender for the general public, and pre and post allotment 'ownership'

Current female allotment holders are consuming well above the figures for the general public (t=5.31 (p=0.000)), however the female allotment holders were already consuming higher proportions of fruit and vegetables than the general public (t= 1.71 p= 0.108).

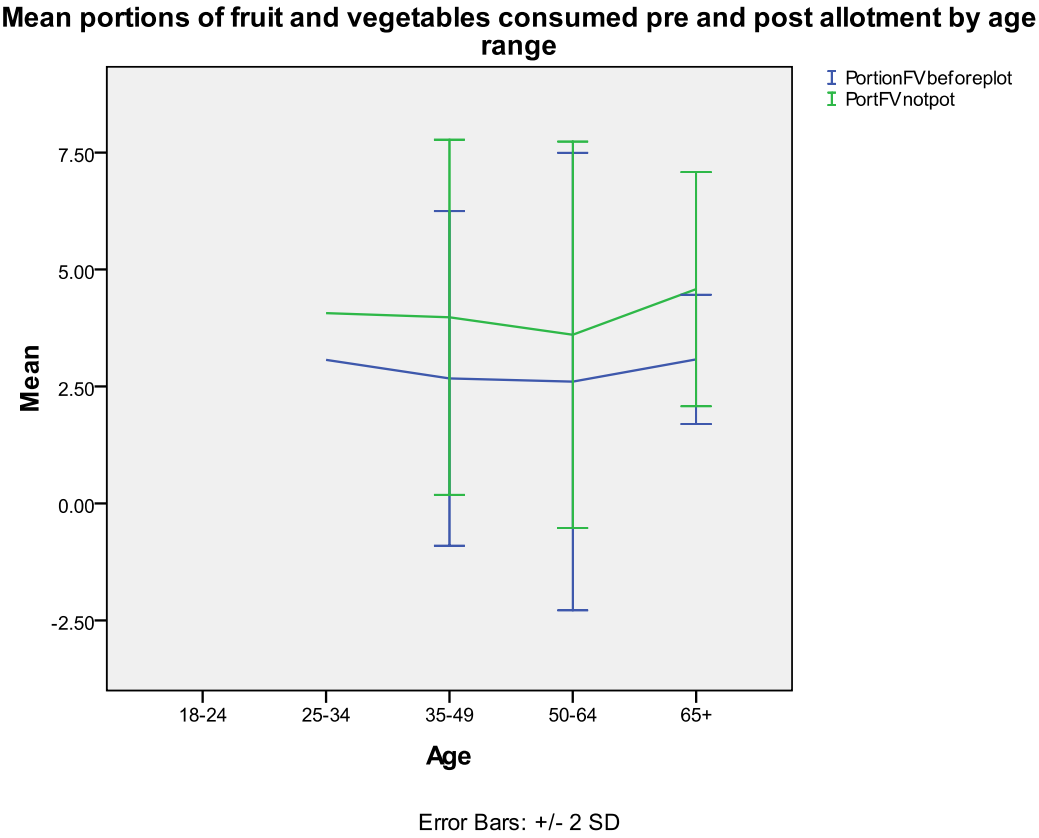
Male allotment holders consume lower levels of fruit and vegetables prior to (t=-2.639 p=0.023) allotment ownership and currently a little over (t=0.308 p=0.764).

3.8 Hypothesis two

Allotment owners consume significantly higher proportions of fruit and vegetables than prior to 'ownership'.

A paired T-test was carried out, t=-7.456 (p>0.001), thus proving the hypothesis.

Figure 42 Mean portions of fruit and vegetables consumed pre and post allotment by age range.



3.9 Hypothesis three

As a result of allotment ownership physical activity levels are significantly higher than the general public.

Current U.K recommendations for physical activity are 30 minutes moderate activity 5 or more times a week. This equates to 900-1200 MET minutes per week.

Allotment holders rated allotment use by physical activity level, gentle, moderate and vigorous, with the majority rating allotment use as a moderate form of physical activity. The same associated activity level (answered in question 1 of Section D of the questionnaire) and the time spent at the allotments in the spring/ summer and autumn/ winter was used to determine the MET minutes per week used by the participants in the spring/summer and autumn/ winter **(Figure 43).**

The mean activity level in the spring/ summer was 351.7 MET minutes per week and in the autumn/ winter was 195.4 MET minutes per week.

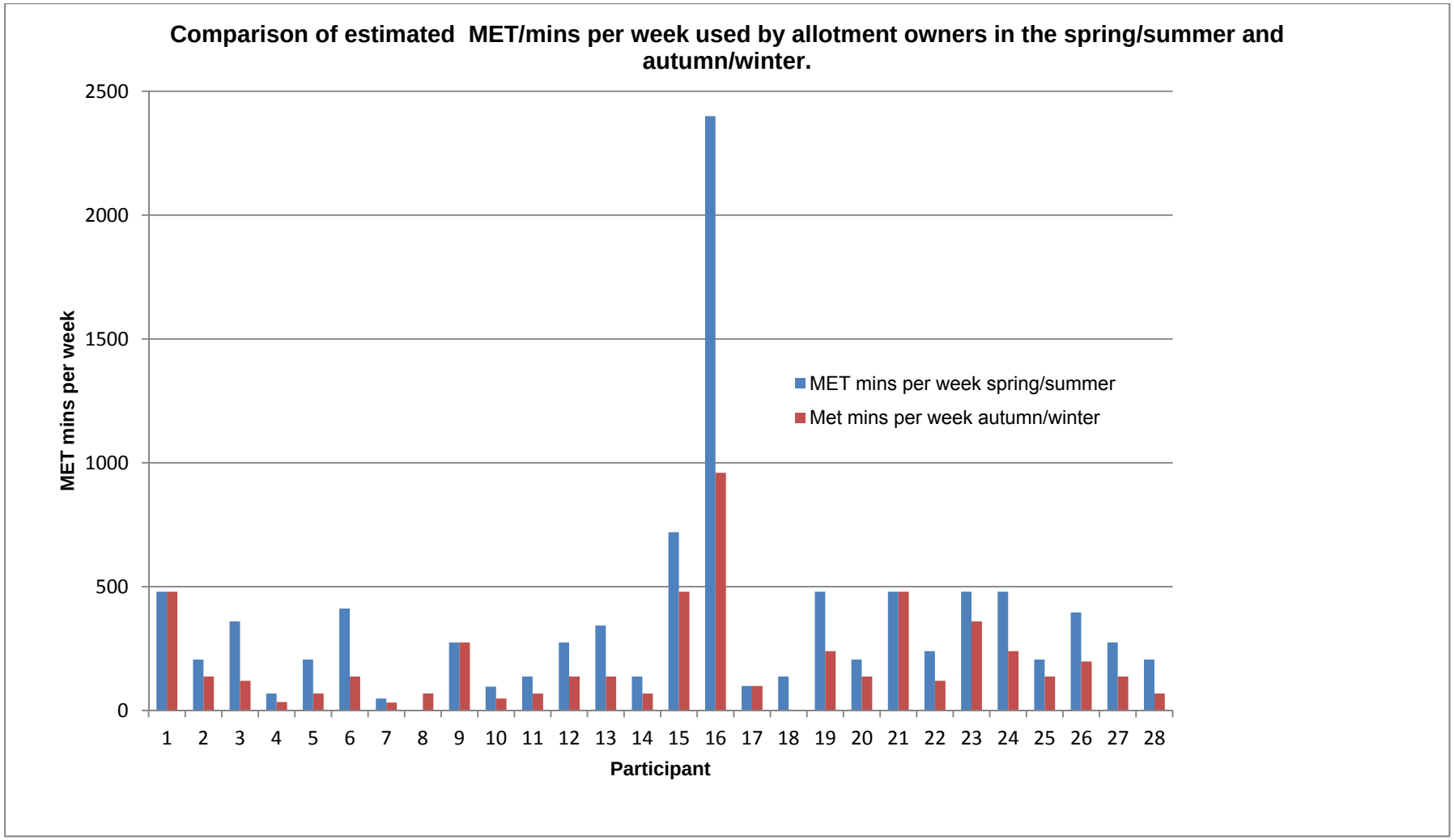


Figure 43 Comparison of estimated MET/minutes per week used by allotment holders.

If the calculated MET values are compared to the upper level of the recommendation 1200 MET minutes per week it can be seen that before allotment ownership 18 participants were meeting this target and after allotment ownership 21 people were meeting this recommendation.

Prior to 'ownership' 6 males and 12 females were meeting the recommendation and post allotment 6 males and 15 females are meeting the recommendation.

A one sample T- test was carried out to compare the recommended value of 1200 MET minutes per week with the mean physical activity both pre and post allotment 'ownership'.

Table 38 Mean MET minutes per weeks for participants both pre and post allotment 'ownership'

	Mean METmins per week	Std. Dev	Std Error	T	p
Pre-allotment	3033	3359	643	2.888	0.008
Post- allotment	3752	3469	656	3.891	0.001

A comparison of total MET values by allotment site can be found in **Figure 44**.

It was assumed that in answering YES to the question 'Has your physical activity level increased since taking up the allotment?' that the level of activity it has increased by is the time spent at the allotment.

If the participant rated allotment use as moderate then the time spent was factored by the moderate level to calculate the increased level of activity since uptake of the allotment.

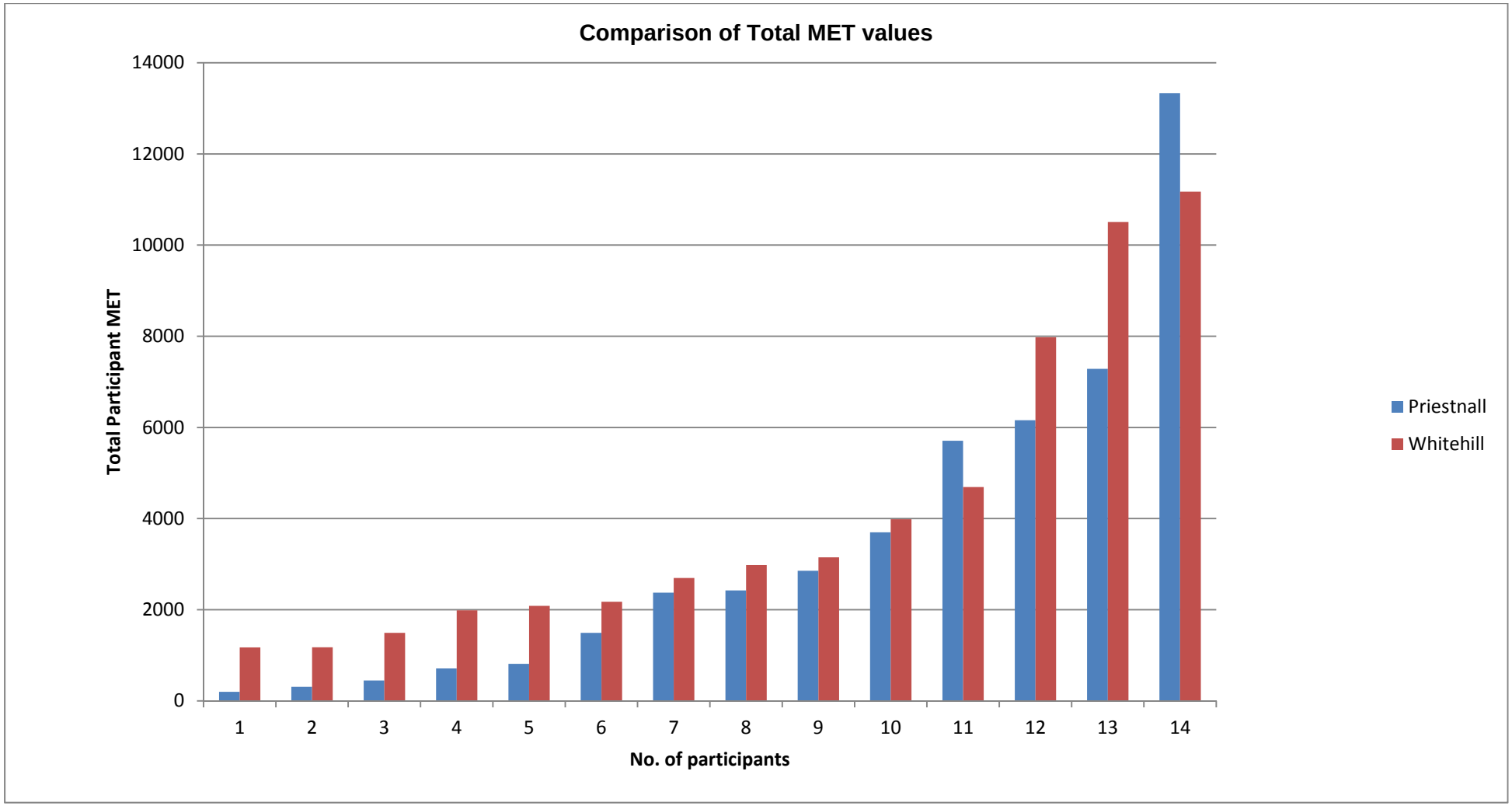


Figure 44 Comparison of current total MET values split by allotment site

3.10 Hypothesis four

As a result of allotment ownership physical activity levels are significantly higher than prior to 'ownership'.

As the distribution was normal parametric testing could be used and therefore a paired sample T-test was carried out on the MET mins for both the pre and post allotment figures, t = -3.06 (p= 0.001)., thus showing a significant effect of allotment use on the physical activity level. **Figure 45** shows the MET levels for the participants pre and post allotment ownership.

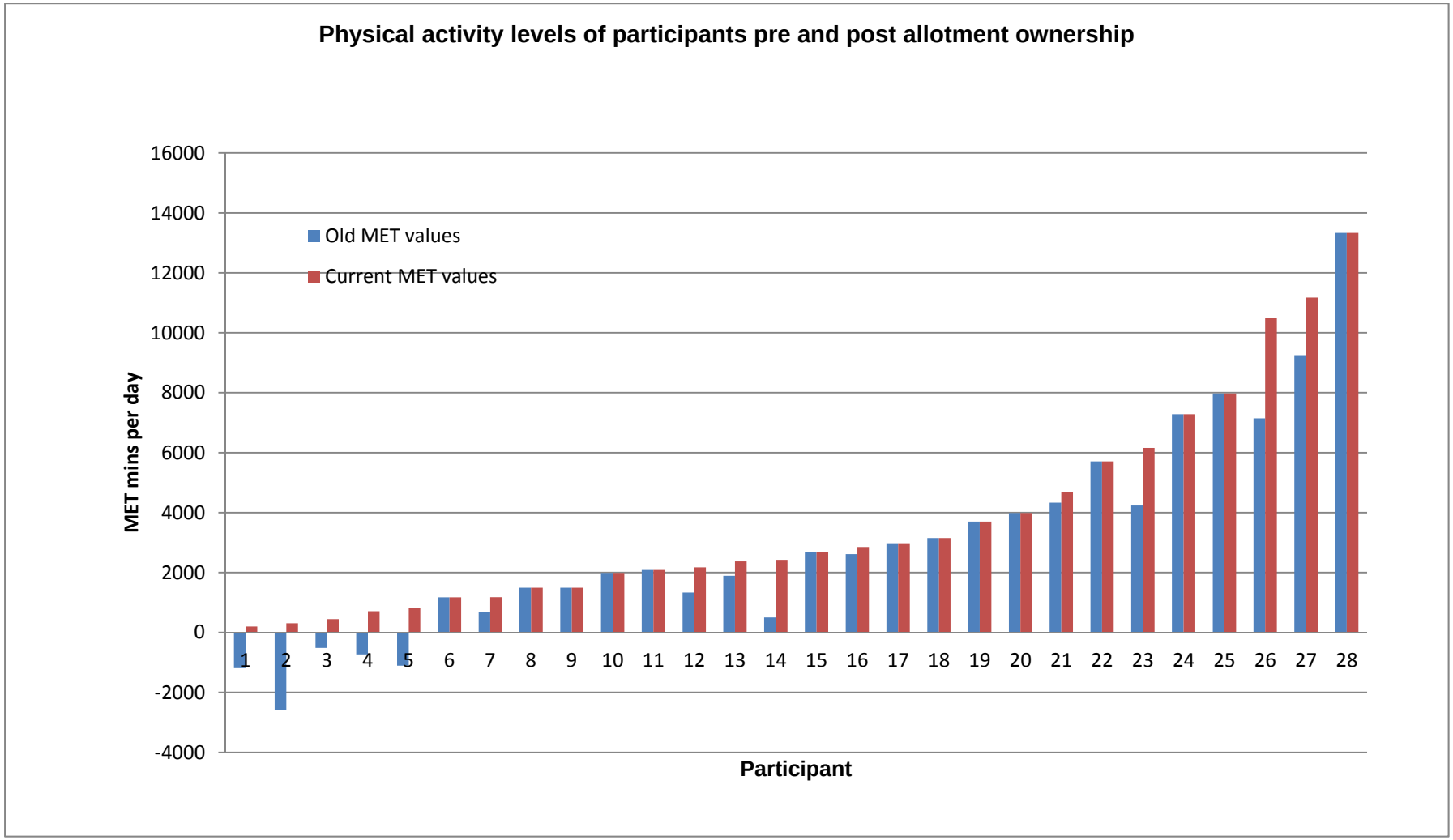


Figure 45 Comparison of participants' physical activity levels pre and post allotment 'ownership

3.11Hypothesis 5

Allotment holders are aware of climate change and are taking responsive action.

Section 3.4 outlines the climate change results from the questionnaire.

Figures 38 and 39 represent allotment holders view points on the effects of crop growth on allotments with climate change. Participants' views of what will grow and what will not grow will differ depending on what the effects are that they associate with climate change.

3.12 Hypothesis 6

Socio-economic location of the allotment has no effect on the results.

In order to clarify that education and socio-economic indicators of deprivation are not skewing the results and acting as a confounder, Univariate analysis of variance test was carried out.

Tests of Between-Subjects Effects

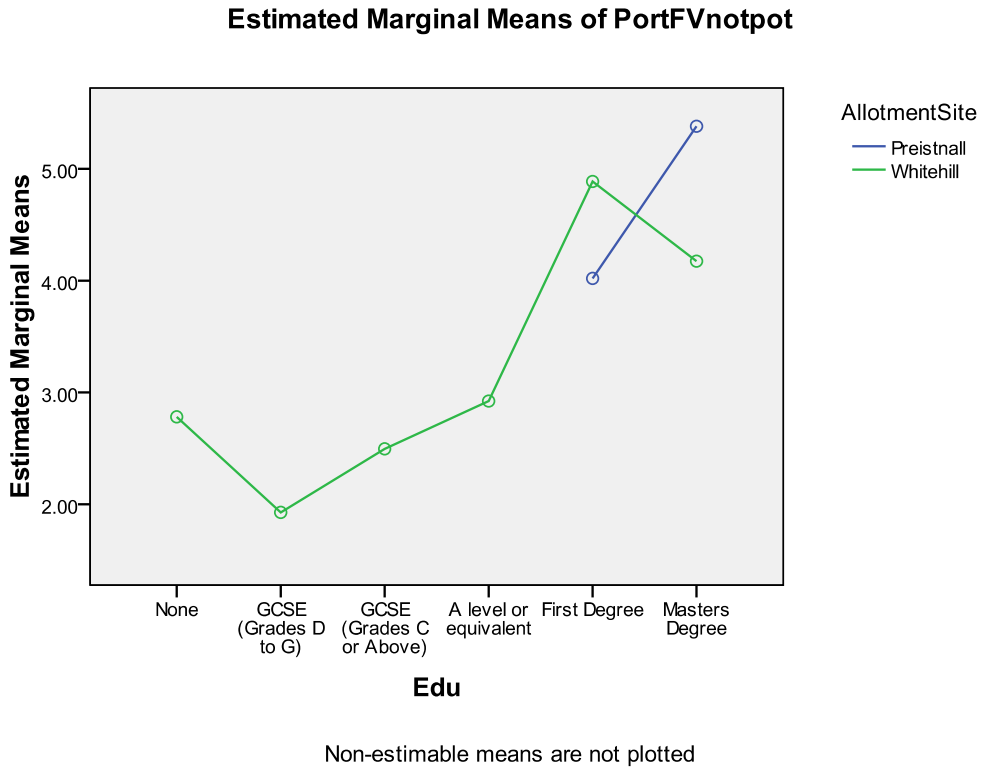
Dependent Variable:PortFVnotpot

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	35.105[a]	7	5.015	2.045	.099
Intercept	252.407	1	252.407	102.937	.000
Edu	10.938	5	2.188	.892	.505
AllotmentSite	.090	1	.090	.037	.850
Edu * AllotmentSite	3.326	1	3.326	1.357	.258
Error	49.041	20	2.452		
Total	532.995	28			
Corrected Total	84.146	27			

a. R Squared = .417 (Adjusted R Squared = .213)

Figure 46 Between-subject effects test, comparing education and allotment site.

Testing for education, F=0.892 (*p=0.505*), allotment site, F= 0.037 (*p=0.850*)



This indicates that allotment site location and education are not linked in their affect on fruit and vegetable consumption and physical activity and therefore implies that any effects seen are due to the allotments and potentially a combination of contributing factors.

Chapter 4: DISCUSSION

'To error is human'

This is the first known study to evaluate allotment use as a potential method for tackling obesity and climate change factors by determining the fruit and vegetable consumption and physical activity levels of a group of Stockport Allotment holders and assessing their awareness of potential climate change issues. The potential value of allotments as a positive solution to a more sustainable health and environmental future has been discussed but not evaluated.

The discussion will cover the main findings and continue to link these findings to the initial research hypotheses set out in the introduction **Section 1.7.2.** Limitations of specific study areas will be discussed where appropriate, as the effect of these limitations is dependent on the research area. Suggestions and implications for future research and policy links will also be discussed.

4.1 Main findings

4.1.1 Demographics

4.1.1.1 Gender

The ratio of male to female allotment holders was 43:67 (n=28). While this proportion is similar to the population, it is possible that with a greater number of males there could have been a change in the findings of the study. This slightly female dominated questionnaire completion may have skewed the fruit and vegetable consumption as women are perceived to be more likely to engage in healthier eating patterns and to adopt lifestyle changes to address issues such as weight management and are more likely to consume more portions of fruit and vegetables.

In previous studies of allotment holders it has been determined that the majority of allotment holders have been male and in the aged range 50-65, the findings of this research suggest more women in the age range 35-49 are tending allotments and is perhaps an indication of the effect of the high profile female role models that are prevalent in the media. The Allotments Regeneration Initiative, which supports and promotes urban allotments, says women make up the fastest-growing group of allotment holders. Some 59,000 of the nation's 330,000 plots are now rented by women. In a survey by the National Society of Allotment and Leisure Gardeners Limited [NSALG] (2007), the population of women tending allotments had risen from 3 to 16 percent between 1969 and 1993 and there is reason to believe that these figures may be underestimated because there is a tendency of shared allotments to be recorded in the man's name. So this could be a true representation of the demographics of the allotment holders in this area and further research could determine the exact numbers of female allotment holders on these sites and the waiting lists.

Conversely it may also be the case that women are more compliant at questionnaire completion than their partners on the allotments. It was observed on several occasions when allotments were being jointly tended that the male continued to work and the female party volunteered to complete the questionnaire.

4.1.1.2 Age

The predominant age group in this study population was 35-49 (46.4 per cent) and less than 25% of the population was of retirement age. These figures when compared with statistics on allotment owners from the House of Commons (1998b) paper **Figure 48** below show that the age demographics appear to be shifting further from the stereotypical retired white gentleman and nearer to the middle aged lady. Unfortunately no participants in this study fell into the age range 18-34; it is not

known whether participants simply do not exist in this age range or whether the sampling framework failed to identify anyone.

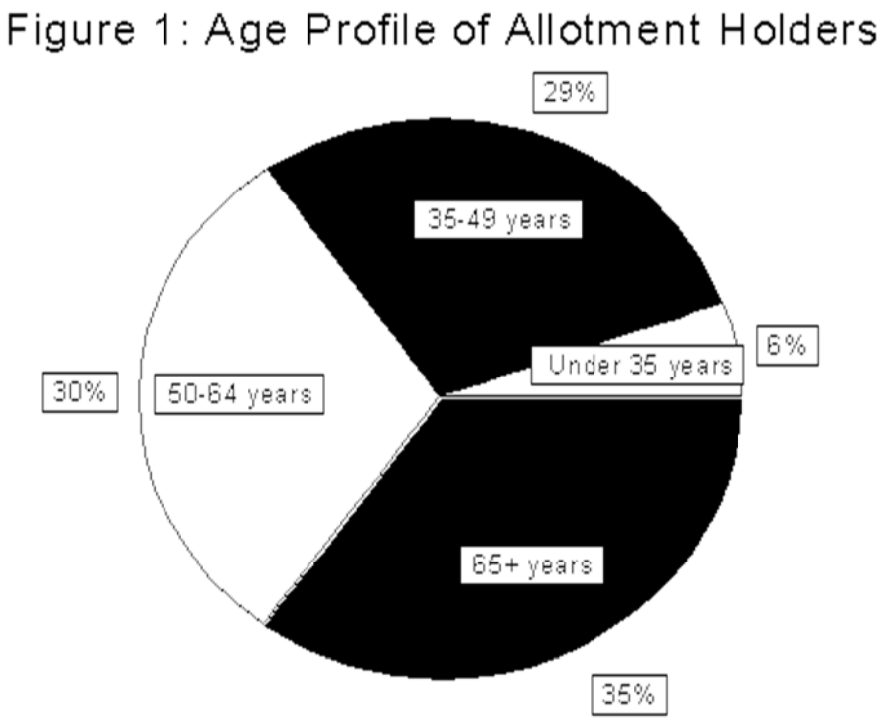


Figure 47 Age profile of allotment holders : source House of Commons (1998b)

This is further supported by research carried out in Bristol, where it was found that over a third of Bristol allotment tenants are now women or couples, many of them with families, and that the number of ethnic minority tenants overall is relatively high compared with participation in many leisure activities. Many new tenants are young professional men and women who have concerns about what they and their families are eating, with a strong move towards organic food and sustainable living. A majority of younger tenants are tending to be from white professional backgrounds, and there is a poor take up among those living in Areas of Deprivation where the need for improved health, fitness and diet is most acute.

4.1.1.3 Education

There was a noticeable difference in educational levels between the participants from the two allotment sites, with none of the Priestnall respondents having achieved less than a first degree and 8 of them having a Masters qualification. This could prove important as research has shown that a higher educational level has a positive effect on fruit and vegetable consumption (Shaikh et al., 2008). The increase in fruit and vegetable consumption was greatest for people who had GCSE (A to D) level education, being 2 portions, with the mean increase being 1.3 portions.

4.1.1.4 Living Conditions

The majority of allotment holders who took part in this study are home owners, and live in either Semi-detached or terraced housing. A difference is seen in the types of houses in the two locations, with the area surrounding the Whitehill site being predominantly terraced housing and the area around Priestnall being more typically detached and semi-detached housing. The type of housing is not necessarily indicative of the socio-economic status of the participant, but is more the housing type available in that area.

4.1.1.5 Employment

The questionnaire, did not differentiate between being unemployed or retired, this was partially due to the ethics of asking personal questions concerning employment and finances. It was thought that this type of question may reduce the response rate. The age range of all the participants is known and therefore, it is possible to determine whether a participant is unemployed or retired. The results suggest , that only one of the participants was unemployed, however this may not be a true

representation of the allotment sites, as discussed in the sampling limitations, because the majority of interviews were taken on a weekend and not during the week, when someone, not working may be more likely to attend their plot.

4.1.1.6 Allotment site

The allotment sites are located in different wards of the Metropolitan Borough of Stockport. Participants from the Priestnall Allotment site consume more fruit and vegetables than those from Whitehill allotment.

4.2 Primary Objective: To clarify the rationale for allotment use as a means of obesity reduction / prevention.

4.2.1 Significance of this study.

The findings of the study, although not generalisable outside the study population, demonstrate that this is an area which warrants further research and is enough to show social trends (Bryman, 2004 pg 101). It appears that allotment users are eating higher quantities of fruit and vegetables than prior to having the allotment (1.2 portions) and more than the general public and the majority are doing more exercise (mean increase 718 MET mins.)

The reasons for plot ownership are mixed but participants are citing both health and environment reasons for plot ownership (**Figure 33**)

4.2.1.1 Significance to Stockport

The findings below from the Neighbourhood Renewal Team, Stockport Council (2009) demonstrate the trends in obesity in Stockport as a whole and they are further reinforced by the IMD 2007, which refers to parts of the Lancashire Hill and Heaton Norris area as the 44th most health deprived area in England out of 32,482

small areas. The Whitehill allotment site is located on the Heaton Norris/Heaton Chapel border.

- Obesity trends follow patterns of deprivation as do patterns of fruit and vegetable consumption although this is not as marked as the association with alcohol and smoking.
- 14% of adults in the two most deprived areas are obese compared to 11% in the two least deprived areas.
- Mental wellbeing also follows patterns deprivation, with of 38% of adults in the two most deprived areas being without mental wellbeing compared to 32% in the two least deprived areas.

Figure 48 Findings of the Neighbourhood Renewal Team, Stockport Council, 2009

Stockport also has a Health Inequalities Strategy which aims to redress this imbalance. The outcomes for health and mental well-being in the Neighbourhood Renewal Strategy correspond to those in the Health Inequalities Strategy and the expectation is that there will be close working between the Neighbourhood Renewal Team and Health colleagues to achieve them. The outcomes for the strategy under this objective are to ensure that:

- People are healthier
- Fewer people smoking
- Reduced drug and alcohol abuse
- Fewer people with obesity
- Improved mental well-being

Figure 49 Outcomes of the Health Inequalities Strategy for Stockport

4.2.2 Allotments and the environment

The U. K. has committed to climate change reductions of 30 per cent of all GHG emissions by 2020 (Climate Change Act, 2008). Research by the University of Manchester suggests that adding 10% green cover to built-up urban areas could keep maximum surface temperatures at a 1961-1990 level up until the 2080s (Hanley and Carter, 2006) .Allotments in built up areas provide such cover. An estimated 33 per cent of respondents in a survey of approximately 2009 people by Defra said that they were currently or intending to grow their own food (TNS, 2009), which indicates that this an area people are thinking about. This study suggests that the average allotment holder, at the two sites evaluated is growing a good mixture of fruit and vegetable crops **Figure 34.** In a recent study (Elbourne, 2009) it was suggested that by growing the soft fruits, leafy greens, legumes, alliums and root vegetables that you would find on a typical allotment it is possible to save approximately 1.50kg CO_2 emissions per m^2 of land.

Figure 50 Avoidable GWP for typical vegetables and soft fruits grown on UK allotments source : Elbourne (2009)

An average allotment plot is 250m^2
1.5k per m^2 x 250 = **375 kg per allotment**

A figure calculated by the Scottish allotments association (SAGS) suggests a considerably higher figure of **1 tonne** of CO_2 per year from a standard allotment (Wilkinson, no date)

It is estimated that there are 300,000 allotments in the UK, so this would result in an approximate CO_2 emissions saving of **112,500000kg** (or 300,000 tonnes if the SAGs figure is used).

Every year, each person in the UK is, on average, responsible for about **14 tonnes** of greenhouse gas emissions. So, to make a cut of 10% across the board, we need to reduce our emissions by about 1.4 tonnes each.

Adult population of the UK 50,893,318 (ONS,2003)

so therefore we need to cut 50,893,318 X 1.4 tonnes

1.4 tonnes is equivalent to 1400kg

= 50,893,318 X 1400kg

= 71250645200kg

Food production is responsible for an estimated one- fifth of total UK greenhouse gas emissions and is a major source of waste (Sustainable Development Commission 2008).

Food production CO_2 to be cut = 14250129040kg

The current potential for allotments to significantly reduce the CO2 emissions is minimal but if you consider the SAG figure of 1 tonne per person, then the 1.4 tonnes reduction per person seems significantly more achievable.

Food production GHG emissions have been increasing, as has the level of obesity; **Figure 51** examines the link between obesity and GHG emissions.

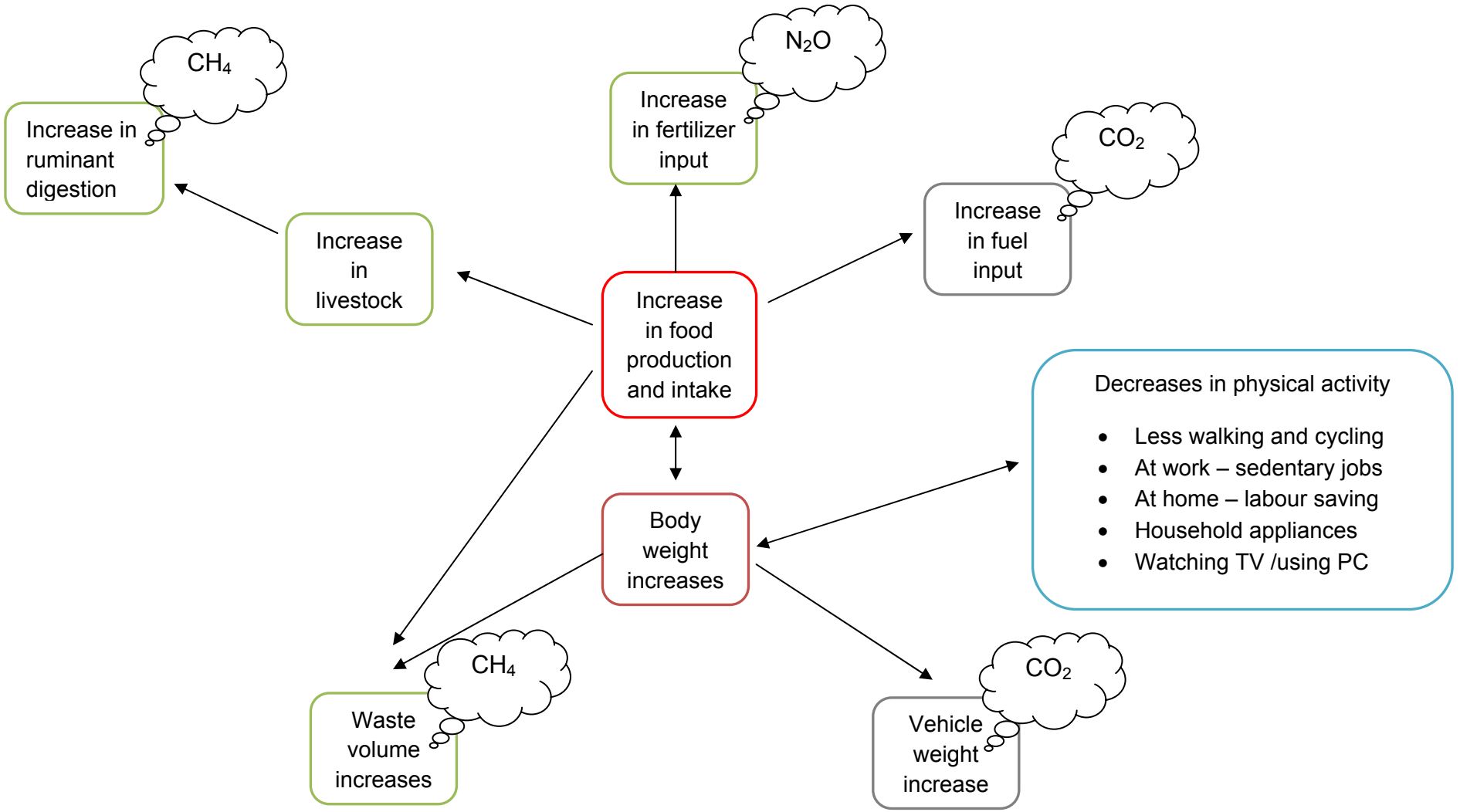


Figure 51 The links between obesity and green house gas emissions. Source: adapted from Michaelow and Dranfield (2006)

4.2.3 Changing UK consumption

Health promotion in the UK recommends a diet that follows the Eatwell plate (FSA,) if UK consumption is to follow this model might it also help in the reduction of GHG emissions? A recent Dutch study calculated the ratio of GHG emissions from the different dietary components **(Figure 52)** and suggests that fruit and vegetables (including potatoes) correspond to GHG emissions of up to 14.6%.

Figure 52 source: Garatt (2006) Green house gas emissions related to Dutch food consumption Klaas Jan Kramer

This also corresponds with a fruit and vegetable contribution of 2.5-3.0 % of the total UK GHG emissions. A recent study suggested that by trying to increase consumption of F &V to meet the 5-a –day target, GHG emissions and wastage

would increase (IGD, 2008), however, if the additional F &V are allotment grown, the environmental cost of transportation and wastage by using seasonal products is significantly reduced.

4. 3 Objective 2: To determine the association between post and pre allotment use and fruit and vegetable consumption.

4.3.1 Main findings

Fruit and vegetable consumption increased with allotment ownership, by an average of 1.2 portions per day and with an increase from 7.1percent to 42.9 percent consuming five or more portions a day. A similar study in the U.S.A produced a portion increase of 1.4 times between community gardeners and the general public.(Alaimo et al. 2008). In general women ate more fruit and vegetables than men, 1.3 and 1.2 additional portions respectively. More women than men consumed the recommended five or more portions of fruit and vegetables daily (25%of men, 29%of women) (HSE, 2008). For men, consumption increased with age, but for women it increased but only slightly, these trends are also confirmed (HSE,2008) with consumption varied with age, increasing from 16-24 (18%of men and 21%of women) up to 55-64 (32%of men and 36%of women) and then decreasing again. Typically, the higher the educational level the more fruit and vegetables that are consumed (NDNS, 2003), however this was not the case in this study, the largest portion increase was seen in participants who has GCSE (A to C). Location appears to have had an effect on consumption, with Priestnall allotment holders eating more fruit and vegetables than Whitehill allotment holders, however this was also true before they 'owned' an allotment, this location effect was also seen in the EPIC Norfolk cohort (Shohaimi, Welch, Bingham, Luben, Day, Wareham, Khaw, 2004),

where education level and employment were seen to have independent effects on fruit and vegetable consumption.

4.4 Objective 3 : Physical activity and allotments.

4.4.1 Main findings

Physical activity levels increased by a mean value of 718 MET minutes per week. The mean post allotment activity level was 3752 MET minutes per week and the government recommendation is 1200 MET minutes per week.

4.4.2 Significance of these results

The majority of participants in this study ranked allotment gardening as 'moderate' physical activity (82%) when asked to compare to other physical activity tasks and several other studies also ranked gardening as moderate to heavy intensity (Brooks, 1998; Ford et al. 1991 and Dannenberg et al. 1989). As gardening is one of the top free time activities undertaken in the U.K. it also suggests that this is an exercise which is usually carried out for sustained periods of time. If the data for the length of time spent a the allotment is considered, it indicates that study participants were spending an average of 3.36 hours, in the spring/summer months and considerably less (2.0 hours) in the winter months. This would imply that allotment use is a significant form of exercise in the warmer summer months and would be less so in the winter months.

HSE (2008) indicates that fewer than 1 in 10 people actually knew the guidelines for physical activity and that 36% of men and 26% woman spent at least 30 mins in moderate activity, 5 or more times a week (ONS,2004).

There is evidence that people would like to do more exercise (HSE, 2008) however, many adults believe they do not have enough time to take part in more physical activity (Trost et al. 2002) and 44% of men and 45% of woman felt they could do enough physical activity in the everyday activities they carried out rather than have to go to a gym.

The Health Survey for England consistently shows a positive correlation between healthy eating measures (e.g. fruit and vegetable consumption) and physical activity measures (e.g. amount of sport per week). This result is not surprising because changes in behaviour in one domain should lead to change in the other, as individuals start identifying themselves as being health conscious.

A community gardening project in an inner city area of Sydney, Australia, which was aimed at encouraging residents to grow their own food, also led to improvements in community feel, and an increase in individuals' sense of purpose when compared to non gardeners (Waliczek, Zajicek and Lineberger ,2005)

The health benefits of 'growing your own' have proven positive but Leake, et al (2009) suggests that other factors should be considered. In their paper they suggest that urban allotments could be at high risk of soil contamination and that consumers of 'grow their own' may be at risk from environmental pollutants in their produce and that risk assessments should be carried out on all sites, in order to reduce the 'fear-factor' in this increasingly risk-averse society.

4.5 Limitations

4.5.1 The Questionnaire

The study was strengthened by recruiting a sample of a size that was estimated to detect meaningful portion effect size in fruit and vegetable consumption. The questionnaire sections, where possible were taken from other validated studies (see questionnaire rationale **Appendix 3**) and each section, including the Food

Frequency Questionnaire (FFQ) to determine fruit and vegetable consumption, was kept reasonably short in order to reduce random response error due to fatigue and excessive burden on the participant (Block and Hartman, 1989) .The questionnaire measures fruit and vegetable consumption by asking participants to answer choosing from the following responses 'never', 1-2 times per week, once a week, etc. and relies on the participant determining what a 'portion' or each item is. One person may report that they consume fruit once a day, and be referring to one or two raspberries and another person may report consuming fruit once a day and be consuming significantly more, say half a punnet of raspberries.

Studies have shown that improvements in portion size estimation can be made by the use of food models and portion size images (Frobisher and Maxwell, 2003). It has also been shown that food energy can affect how portions are estimated. In research by Japur and Diex-Garcia (2010) it was discovered that low energy foods such a fruit and vegetables were typically under-reported, whereas higher energy density foods had a tendency to be over-reported. People's perception of what is considered a 'healthy food' can also affect their portion size estimation, with perceived 'healthy foods being over-estimated (Becker and Welten, 2001). Prior to these questions being asked the interviewer did ask the participant whether they were aware what a portion consisted of, in order to try and limit reporting differences.

The base line fruit and vegetable consumption was calculated by subtracting the additional portions of fruit and vegetables that the participants approximated that they consume as a result of allotment ownership. This is reliant on the recall of the participant and in the case of a long term allotment holder may be flawed. A participant who has had an allotment for 30 plus years is unlikely to answer with the same degree of accuracy as someone who started their allotment 6 months ago.

A more robust study would have been to take participants from the waiting list and ask questions on their fruit and vegetable consumption, may be even ask them to complete a weighed food diary as the baseline data and then to return to the population group at intervals after their allotment ownership to repeat the process. This however was not possible within the confines of an MSc study.

4.5.2 Selection Bias

In every survey there will be some form of selection bias, with every participant having differing motives and reasons to take part. This survey offered an incentive for completion of several packets of seeds, but this was not always mentioned before the survey was completed.

The data collection took place, mostly on the weekends at specific times when the allotment sites were open. This would exclude anyone who only attended the allotment during the week, potentially the unemployed and would result in a surplus of people who work during the week.

4.5.3 Self-reported data

There are always errors in self reported data, such as under and over reporting, and recall bias. Under and over-reporting have been discussed briefly in **Section 4.5.1.**

All of these are likely to have occurred during the data collection for this report.

4.5.3.1Recall bias

Any questionnaire which asks participants to refer to events or actions from a retrospective point of view, for example ‘prior to allotment ownership’ is subject to recall bias, particularly if the participant is a long term allotment holder. Recall relies on memory which can often be imperfect and therefore unreliable (Hassan, 2006)

and the longer the time interval, the higher the probability of incorrect recalls (Margetts, Vorster and Venter (2003). By allowing respondents enough time to answer the questions, provides time to reflect on the sequence of life events before answering (Bradburn, Rips and Shevell, 1987) and thus minimises the error.

A control group could have been used to reduce the effect of recall bias or as decided in this study, the use of proxy sources of data (Hassan, 2006).

4.6 Further areas of study

Although the data and results are accurate for the two study locations, it is unknown; whether the findings would be similar if the study was carried out on further allotment sites, throughout Stockport, the North West or even the U.K. In order to evaluate this further it would be necessary to repeat this study over a wider area, with a larger sample size.

In order that recall bias is further reduced to a minimum in the study, a more robust study would be a longitudinal study in which a population of 'want-to-be' allotment holders are surveyed prior to allotment uptake and then at significant time intervals, of 6 months and 1 year to discover potential changes in eating and exercise habits.

The reasons for allotment use could be used for a future marketing strategy for a targeted health campaign. Tailoring campaigns to a specific age group has proven more successful in inducing behaviour change (Butriss et al. 2004)

Low-income families, in particular are at risk of failing to eat a healthy diet. (Margetts et al. 1998; Anderson and Hunt 1992) Another possible area for future research would be to follow a group of children to evaluate the long-term health effect of involvement in grow your own type projects because research has shown that

children can have established long term health choices after being shown healthy choices from an early age (Ness et al. ,2005)

Chapter 5 - CONCLUSIONS

The general findings of this research point strongly towards there being a significant difference in fruit and vegetable consumption and physical activity levels of allotment owners than population averages and in fact that consumption levels increased from prior to 'ownership'. The majority of allotment 'owners' are aware of climate change and although not all think that it will affect the use of allotments, many offered suggestions of how they would adapt to climate change.

Due to the limitations of the study in its sampling and the resource and time restraints of an MSc the results found, although significant findings, are not generalisable to wider populations, such as Stockport or the North West. What they do is offer a suggestion that this is an area that would warrant further research and investigation, especially if this is to be a chosen method in efforts to tackle obesity.

Suggestions for further study would take the form of either using a control group, in order to eliminate the recall bias that occurs, especially in longer term allotment holders, or to carry out a longitudinal study in which the same sample of allotment holders are followed over time, with base line consumption and exercise levels being taken and ideas on climate change and then the sample is revisited after a significant period of time having the allotment, after 6 months, 12 months, 2 years and the data compared.

A seasonal response was noted to the amount of fruit and vegetables being produced by the allotment and to the time spent at the allotment site; this would need to be taken into account if planning to use allotments to tackle obesity.

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Appendices

Appendix 1 - Research tools

Food, Physical activity, Climate change perspectives in relationship to allotment ownership

VOLUNTEERS WANTED

Date: From December '09 – March '10
Location: On allotment site

What would this involve?

Participants will be required to respond to a short, face -to- face interviewer completed questionnaire or a self administered questionnaire, duration approx. 20 mins

What will I receive?

As a thank you all volunteers will receive a packet of seeds on completion of the questionnaire.

Interested?

Please call Ann on for more information or e-mail @chester.ac.uk.

ALLOTMENT STUDY

ALLOTMENT STUDY

ALLOTMENT STUDY @chester.ac.uk

ALLOTMENT STUDY

Appendix 1 : Flyers

University of Chester

Food, Physical activity, Climate change perspectives in relationship to allotment ownership

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VOLUNTEERS WANTED

Date: From December '09 – March '10

Location: On allotment site

What would this involve?

Participants will be required to respond to a short, face -to- face interviewer completed questionnaire or a self administered questionnaire, approx. duration 20mins.

What will I receive?

As a thank you all volunteers will receive a packet of seeds on completion of the questionnaire.

Interested?

Please call Ann on for more information or e-mail @chester.ac.uk.

University of Chester

Food, Physical activity, Climate change perspectives in relationship to allotment ownership

VOLUNTEERS WANTED

Date: From December '09 – March '10

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Interested?

Please call Ann on for more information or e-mail @chester.ac.uk.

Appendix 1 -Pre-screen Questionnaire

University of Chester

Pre-screen Questionnaire

Office use only	
Participant no.	Date of Interview

INTERVIEW QUESTIONS.

1. Could you please tell me your age?

Age	
18 +	<18
Eligible	**Not eligible**

If above criteria are not met, interviewer says:
"I am sorry, but unfortunately our research study requires participants to be 18 or over. However, we thank you for your interest and invite you to call us again for a future study."

If the above criteria are met, interviewer proceeds to Question 2.

2. Could you please tell me if you are a vegetarian?

	YES	NO
CRITERIA	**Not eligible**	**Eligible**

"I am sorry, but unfortunately our research study includes some strict criteria, which makes our design unsuitable for you on this occasion. However, we thank you for your interest and invite you to call us again for a future study."

3. *Do you have any condition at the moment that affects your diet, appetite or food intake?*
If so, which condition?

Cannot participate if he has: diabetes, cardio-vascular disease, high levels of blood lipids, flu, other conditions affecting appetite or food intake.

	YES	NO
CRITERIA	**Not eligible**	**Eligible**

4. Are you taking any prescription medications or supplements which may affect your appetite?

	YES	NO
CRITERIA	**Not eligible**	**Eligible**

5. Could you please tell me if you smoke?

	YES	NO
CRITERIA	**Not eligible**	**Eligible**

6. Do you have any allergies to fruit or vegetables?

	YES	NO
CRITERIA	**Not eligible**	**Eligible**

7. Do you have prior knowledge of this study?

	YES	NO
CRITERIA	**Not eligible**	**Eligible**

8. Have you had any nutrition training?

	YES	NO
CRITERIA	**Not eligible**	**Eligible**

9. Could you please tell me your approximate weight and height?

Weight	
Height	

Interviewer consults BMI chart	
BMI	

Qu. 10. Could you confirm for me the first part of your postcode?

Appendix 1 - Participant Information Sheet

Participant information sheet

Allotment ownership and its effect on fruit and vegetable consumption in several wards of Stockport.

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask questions if there is anything that is not clear or if you would like more information. Please take time to decide whether or not you wish to take part.

What is the purpose of the study?

This research project will explore the issues associated with access to healthy foods, and in particular, the use of allotments/community gardens as facilitators to consuming five or more portions of fruit and vegetables per day. A large proportion of the population in England consume less than the recommended amount of fruit and vegetables (5-a-day). By discussing your views on this matter in the form of a face-to-face researcher completed survey or self-completed questionnaire, this study will aim to highlight the effects allotment ownerships has on consuming five or more portions of fruit and vegetables in Stockport and the levels of physical activity achieved by users. Climate change perspectives and allotment ownership will also be investigated. A written report will be produced at the end of this study. The findings of the study may be used by Stockport Primary Care Trust and/or Stockport Council to develop methods of obesity reduction in your local area. They are not however, directly involved in this research.

Why have I been chosen?

You have been chosen because you live in one of the areas of interest to this study and are a regular allotment user or grow your own food.

Do I have to take part?

It is up to you to decide whether or not to take part. If you decide to take part, you are still able to withdraw from the research at any time without giving a reason. A decision to withdraw or not take part will not affect you in any way.

What will happen to me if I take part?

If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. This will give your consent for a researcher from University of Chester to receive information from you in a face to face interview or via telephone interview, as arranged. At this session, you will have the opportunity to answer preset questions about your views and experiences of the study subject. The face-to-face, or telephone interview will be led by a researcher (Ann Hunt) and will last approximately 20 minutes. With your permission, the interview may be audio taped for checking of accuracy of interviewer documentation. The alternative to self-complete the questionnaire is also available. No-one will be identifiable in the final report.

What are the possible disadvantages and risks of taking part?

There are no disadvantages or risks foreseen in taking part in the study.

What are the possible benefits of taking part?

As a resident of Stockport it is possible that you may welcome the opportunities to share your views and experiences with other residents. The sessions will act as an opportunity for you to vent concerns regarding access to healthy food in your area of residence. Your concerns/views may form the basis of the research which may be presented to relevant parties/services (i.e. Stockport Council (re: waiting list issues), Stockport Primary Care Trust) who may take steps to improve certain aspects of your area in order to help residents consume healthy food.
You may become aware of food outlets you were unaware of that may save you time and/or money when food shopping. You may also pick up ideas from other participants about healthy eating and/or access to healthy food.

What is something goes wrong?

If you have any concerns or wish to complain about any aspect of the way you have been approached or treated during the course of the study, please contact

Professor Sarah Andrew,
Dean of the School of Applied and Health Sciences,
University of Chester,
Parkgate Road, Chester,
CH1 4BJ, United
Kingdom, 01244 513055.

Email: s.andrews@chester.ac.uk

If you are harmed by taking part in this research project, there are no special compensation arrangements. If you are harmed due to someone's negligence (but not otherwise), then you may have grounds for legal action, but you may have to pay for this.

Will my taking part in the study be kept confidential?

All information that is collected about you during the course of the research will be kept strictly confidential so that only the researcher and the researcher's supervisor will have access to such information. All data containing personal information will be coded in order to maintain your anonymity.

What will happen to the results of the research study?

The results will be written up into a report for a committee of MSc Dissertation assessors. It is hoped that the findings of this research may also be used by local services to help improve any issues that arise from the research. Individuals who participate will not be identified in any subsequent report or publication.

Who is organising and funding the research?

The research is organised by the University of Chester and undertaken by Ann Hunt under the supervision of Professor C. Burek or Dr. B. Ellahi.

Whom may I contact for further information?

If you would like more information about the research before you decide whether or not to take part, please contact: Ann Hunt – @chester.ac.uk, mobile
University of Chester, Parkgate Road, Chester, CH1 4BJ

Thankyou for your interest in this research.

If you decide not to take part, please call us at the number above to let us know.

University of Chester

Appendix 1 : Consent form

Consent form

Title of Project: An exploration of food, physical activity and climate change perspectives in relationship to allotment ownership.

Name of Researcher: Ann Hunt

Please initial box

1. I confirm that I have read and understood the participant information sheet for the above study and have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason and without my care or legal rights being affected. ☐

3. I agree to take part in the above study. ☐

4. I agree to the recording of the interview for data recording purposes and is only for use by the lead researcher. ☐

_____	_____	_____
Name of Participant	Date	Signature
_____	_____	_____
Name of Person taking consent (if different from researcher)	Date	Signature
_____	_____	_____
Researcher	Date	Signature

Appendix 2: Questions on the Pilot questionnaire

Pilot questionnaire

Allotment 'ownership' increases fruit and vegetable consumption

Dear participant,

You are being invited to assist in the development of the questionnaire for the above study. Pleas e read the participant in formation sheet and the questions below, before attempting to complete the questionnaire.

Please take your time to complete the questionnaire and then answer the questions below:

1) Was the participant information sheet clear?

2) How long did the questionnaire take you to complete?

3) Did you find the instructions easy to follow?

4) Did you object to completing any of the questions

5) Were any of the questions ambiguous or unclear?

   If so, which ones and in what way?

6) Have any major topics been omitted, in your opinion?

7) Was the layout clear and aesthetically pleasing?

8) Any further comments?

   Thank you for taking the time to assist in this research, you help is much appreciated, if you have any further questions please contact Ann Hunt by email on:
   @chester.ac.uk

Appendix 2: Piloted Questionnaire.

University of Chester

Allotment users survey – Draft 1

Participant no. | | | | |

Date of Interview | | | | | | |

Name of Allotment site

Plot No.

General Instructions

1) **Answer each question as best as you can, estimate the answer if unsure, this is better than no answer.**
2) **Mark your answer with a X.**
3) **If you answer other to any question, please specify.**
4) **If you answer <u>None</u> or <u>No</u> to any questions, follow the arrows guiding you to the next question.**

SECTION A - DEMOGRAPHICS

1. **What is your age range?**

	17-24		**25-34**	**X**	**35-49**		**50-64**		**65+**

2. **Gender**

X	**Male**		**Female**

3. **What is your ethnic background**

	Bangladeshi		**Black (African)**		**Black (Caribbean)**		**Indian**
	Pakistani	**X**	**White**		**Other (please state)**		

4. How would you describe your current living arrangements?

	Live alone		Live in a shared house		Live with parents	X	Live with partner
X	Living with dependent children				Other (please state)		

5. Residence type

	Apartment/flat		Terraced	X	Semi-detached		Detached

6. What is the highest level of your educational qualifications?

	None		GCSE (Grades D to		GCSE (Grades C or	X	A level or equivalent
	First Degree		Master's Degree		Doctorate		

7. Are you currently employed?

X	Yes		No

SECTION B – ALLOTMENT INFORMATION

1. How long have you held a plot?

	Less than 6 months	X	6 -12 months		1-2 years		Over 2 years

2. Frequency of attending plot

	Daily		Every other day		Twice/week		Once/ week
X	Fortnightly		Monthly		Less than once/month		

3. **Hours spent at each visit**

	1 hour		**2 hours**	**X**	**3 hours**		**4 hours**
	5 hours		**6 hours or more**		**Other (please state)**		

4. **Do you attend your allotment alone or with other family members?**

	Alone	**X**	**With family member**

5. **How do you travel to the plot?**

	Walk		**Cycle**	**X**	**Car**		**Bus**
	Other(please specify)						

6. **Reasons for plot ownership?**

Please state briefly you reasons for allotment 'ownership'.

Possibility to grow more veg than we have room for at home

7. **Crops grown**

	Yes	**No**
Potatoes	**X**	
Carrots	**X**	
Peas	**X**	
Runner beans	**X**	
tomatoes	**X (but disaster -> blight!!!)**	
parsnips		**X**
pumpkins	**Attempted**	
strawberries	**X**	
blackcurrants		**X**
Flowers	**X**	
Others (please specify)	**Sweetcorn Brassicas (Red cabbage, broccoli)**	

8. Do you purchase also fruit and vegetables?

X	Yes		No

9. What proportion of the fruit and vegetables you consume do you grow?

	All		75%		50%	X	25%

Climate change will it make a difference?

10. Below are climate change factors, please indicate all which you think may be more frequently observed with climate change.

	Snow	X	Wind	X	Rain	X	Drought
	Lightning strikes/storms		Seasonality	X	Temperature increase		Temperature decreases

11. Will climate change affect use of allotments?

X	Yes		No

12. How will it affect the allotments?

X	Drought		Increased insects/bugs	X	Change of crops		Drought
	Lightning strikes/storms		Flooding		Temperature increase		Other

13. Will you plan to grow different crops because of this?

	Yes	X	No

14. Which crops do you anticipate being able to grow in warmer temperatures?

15. Which crops do you anticipate NOT being able to grow in warmer temperatures?

SECTION C – FRUIT AND VEGETABLE CONSUMPTION[3]

In the last month, about how often did you drink (or eat):

1. **100% orange juice or 100% grapefruit juice?**

X	**Never**		**1-3 times last month**		**1-2 times / week**		**3-4 times / wk**
	5-6 times / week		**1 time / day**		**2 times / day**		**≥ 3 times / day**

2. **Other 100% fruit juices, such as apple or grape juice? (Do not count fruit drinks such as Hi-C)**

X	**Never**		**1-3 times last month**		**1-2 times / week**		**3-4 times / wk**
	5-6 times / week		**1 time / day**		**2 times / day**		**≥ 3 times / day**

3. **French fries or fried potatoes?**

	Never	X	**1-3 times last month**		**1-2 times / week**		**3-4 times / wk**
	5-6 times / week		**1 time / day**		**2 times / day**		**≥ 3 times / day**

4. **Baked, boiled or mashed potatoes?**

	Never		**1-3 times last month**		**1-2 times / week**	X	**3-4 times / wk**
	5-6 times / week		**1 time / day**		**2 times / day**		**≥ 3 times / day**

For morning, lunchtime and afternoon, and evening and night time separately:

[3] **Thompson, F. E., Kipnis, V., Subar, A. F., Krebs-Smith, S. M., Kahle, L.L., Midthune, D., Potischman, N. and Schatzkin, A. (2000)** Evaluation of 2 brief instruments and a food-frequency questionnaire to estimate daily number of servings of fruit and vegetables. *American Journal of Clinical Nutrition Vol. 71, No. 6, 1503-1510*

5. **On how many days in the month did you eat fruit for your meals or snacks? (Do not count juices).**

	Never		**1-3 days last month**		**1-2 days / week**		**3-4 days / wk**
	-6 days / week		**Every day**	**X**			

6. **When you are fruit in the last month, how many portions of fruit did you usually eat?(Count each piece or one-half cup you at as one portion, whether it was one fruit or different fruits.)**

	1 portion of less		**2 portions**	**X**	**3 portions**

7. **On how many days in the last did you eat vegetables for your meal or snacks? (Do not count potatoes.)**

	Never		**1-3 days last month**		**1-2 days / week**		**3-4 days / wk**
	5-6 days / week		**Every day**	**X**			

8. **When you ate vegetables in the last month, how many total portions of vegetables did you usually eat? (Count each one-half cup you ate as one portion, whether it was one vegetable or different vegetables)**

	1 portion of less	**X**	**2 portions**		**≥ 3 portions**

9. **Do you feel that your intake of fruit and vegetables has altered, since taking up your allotment**?

	Yes	**X**	**No**

10. **If yes, by approximately how much a day?**

	1 portion of less		**2 portions**		**≥ 3 portions**

SECTION D- PHYSICAL ACTIVITY[4]

The following question concern your physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and garden, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   days per week

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   hours per day

   minutes per day

   ☐ Don't know not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   days per week

   ☐ No moderate physical activities → ***Skip to question 5***

[4] Taken from International Physical Activity Questionnaire.(August 2002)Short last 7 days self-administered format. For use with young and middle-aged adults (15-69 years) retrieved from www.ipaq.ki.se

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

hours per day

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

days per week

☐ No walking → ***Skip to question 7***

11. How much time did you usually spend walking on one of those days?

_____ **hours per day**

minutes per day

☐ **Don't know/Not sure**

The last question is about the time you spent **sitting** on weekdays during the last **7 days.** Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

12. During the last **7 days, how** much time did you spend sitting on **a week day?**

hours per day

_____ **minutes per day**

☐ **Don't know/Not sure**

13. Do you feel that your exercise levels have altered, since taking up your allotment?

	Yes	**X**	**No**

14. If yes, by how much?

_____ **days per week**

_____ **hours per day**

_____ **minutes per day**

This is the end of the questionnaire, thank you for participating.

Appendix 2: Summary of the results of the Pilot Study

Question		Participant response					Combined result
		1	2	3	4	5	
1	Was the participant information sheet clear?	Yes	Yes	Yes	Yes	Yes	Yes
2	How long did the questionnaire take to complete?	20 mins	15 mins	20 mins	10 mins	20 mins	17 mins
3	Did you find the instructions easy to follow?	Yes	Yes	Yes	Yes	Yes	Yes
4	Did you object to answering any of the questions?	No	No	No	No	No	No
5	Were any of the questions ambiguous or unclear?	No	Yes	Yes	Yes	Yes	Yes
	If so which ones?	None	B3, B5,B8	B9, B14,B15	B9, C9, D13	B8	
			D4, D 14		B14 B15		
7	Have any major topics been omitted, in your opinion?	Competetive sport	No	Which food outlets	Cost of allotments		
8	Was the layout clear and aesthetically pleasing?	Ok	Yes	Yes	Yes	Yes	
9	Any further comments?	Very interesting piece of work	I look forward to hearing the results	none	Well grouped questions	The results will be seasonal	

Appendix 3: Revised Questionnaire

University of Chester

Office use only

Participant no.				Date of Interview						

Name of Allotment site ____ Plot No.

Allotment holders' survey

General Instructions

There are 2 ways of completing this questionnaire:

i) hand write your answers in the boxes and send/ fax it back,

ii) type in the boxes and email the questionnaire back to @chester.ac.uk

- Answer each question as best as you can, estimate the answer if unsure, this is better than no answer.
- Mark your answer with a **X**.
- If you answer **Other** to any question, please specify.
- If you answer **No** to any questions, follow the arrows to the next question.
- Answering a question is optional, if you are not comfortable answering, please move on to the next question.

SECTION A - DEMOGRAPHICS

1. What is your age range?

☐ 18-24 ☐ 25-34 ☐ 35-49 ☐ 50-64 ☐ 65+

2 .Gender

☐ Male ☐ Female

3. What is your ethnic background?

☐ Bangladeshi ☐ Black (African) ☐ Black (Caribbean) ☐ Indian

☐ Pakistani ☐ White ☐ Other (please state) ☐

4. How would you describe your current living arrangements?

☐ Live alone ☐ Live in a shared house ☐ Live with parents ☐ Live with partner

☐ Living with dependent children ☐ Live with partner & dependants ☐ Other (please state) ☐

5 How would you describe your current residence type?

a. Do you..

☐ Own ☐ Rent

b. How would you best describe your home?

☐ Apartment/ flat ☐ Terraced ☐ Semi-detached ☐ Detached

6. What is the highest level of your educational qualifications?

☐ None ☐ GCSE (Grades D to G) ☐ GCSE (Grades C or Above) ☐ A level or equivalent

☐ First Degree ☐ Master's Degree ☐ Doctorate

7. Are you or anyone else in your household currently employed?

☐ Yes ☐ No

SECTION B – ALLOTMENT INFORMATION

16. How long have you held a plot?

☐ Less than 6 months ☐ 6 -12 months ☐ 1-2 years ☐ Over 2 years

☐

if over 2 years please specify

17. How often do you attend the plot?

☐ Daily ☐ Every other day ☐ Twice/week ☐ Once/ week

☐ Fortnightly ☐ Monthly ☐ Less than once/month ☐

18. How many hours do you spend at each visit:

a. In the spring and summer?

☐ 1 hour ☐ 2 hours ☐ 3 hours ☐ 4 hours

☐ 5 hours ☐ 6 hours or more ☐ Other (please state) ☐

b. In the autumn and winter?

☐ 1 hour ☐ 2 hours ☐ 3 hours ☐ 4 hours

☐ 5 hours ☐ 6 hours or more ☐ Other (please state) ☐

19. Do you attend your allotment alone or with other family members?

☐ Alone ☐ With family member

20. How do you travel to the plot? Please mark all that apply.

☐ Walk ☐ Cycle ☐ Car ☐ Bus

☐ Other(please specify) ☐

21. Reasons for plot ownership? Please state briefly your reasons for allotment 'ownership'.

☐

22. Of all the fruit and vegetables consumed by you in a month, what proportion comes from your allotment?

☐ All ☐ 75% ☐ 50% ☐ 25%

23. Do you also purchase fruit and vegetables?

☐ Yes ☐ No

24. If yes, where do you purchase the remaining fruit and vegetables? Please mark all that apply.

☐ Supermarket ☐ Farmers' market ☐ Veg. Box. Scheme ☐ Other

25. Which crops do you grow on the allotment? Please mark **all** that apply.

	Yes	No
Potatoes		
Carrots		
Peas		
Runner beans		
Tomatoes		
Parsnips		
Pumpkins / Squash / Marrow		
Brassica (Cabbage, Broccoli, Cauliflower)		
Sweetcorn		
Strawberries		
Cane fruit (Blackcurrants, Redcurrants)		
Orchard Fruits (Apples, Pears, Plums)		
Flowers		
Others (please specify)		

Climate change: will it make a difference?

26. Below is a list of climate change factors. Please indicate **<u>all</u>** which you think may be more frequently observed with climate change.

☐ Snow ☐ Wind ☐ Rain ☐ Drought

☐ Lightning strikes/storms ☐ Decreased Seasonality ☐ Temperature increase ☐ Temperature decrease

27. Will climate change affect use of allotments?

☐ Yes ☐ No ***if No Skip to Section C***

28. If yes, how soon do you think the effects of climate change will be felt?

☐ 0-1 years ☐ 2-5 years ☐ 6-10 years ☐ 20 + years

☐ Not in my life time ☐ Other (please state) ☐

29. How do you think it will affect the allotments?

☐ Drought ☐ Increased insects/bugs ☐ Change of crops ☐ Lightning strikes/storms

☐ Temperature increase ☐ Flooding ☐ Other (please state) ☐

30. Will you plan to grow different crops because of this?

☐ Yes ☐ No

31. Which crops do you anticipate being able to grow in warmer temperatures?

☐

32. Which crops do you anticipate **not** being able to grow in warmer temperatures?

☐

SECTION C – FRUIT AND VEGETABLE CONSUMPTION[5]

In the last **month**, about how often did you drink (or eat):

15. 100% orange juice or 100% grapefruit juice?

☐ Never	☐ 1-3 times last month	☐ 1-2 times / week	☐ 3-4 times / week
☐ 5-6 times / week	☐ 1 time / day	☐ 2 times / day	☐ ≥ 3 times / day

16. Other 100% fruit juices, such as apple or grape juice? (Do not count fruit drinks such as Hi-C)

☐ Never	☐ 1-3 times last month	☐ 1-2 times / week	☐ 3-4 times / week
☐ 5-6 times / week	☐ 1 time / day	☐ 2 times / day	☐ ≥ 3 times / day

17. French fries or fried potatoes?

☐ Never	☐ 1-3 times last month	☐ 1-2 times / week	☐ 3-4 times / week
☐ 5-6 times / week	☐ 1 time / day	☐ 2 times / day	☐ ≥ 3 times / day

18. Baked, boiled or mashed potatoes?

☐ Never	☐ 1-3 times last month	☐ 1-2 times / week	☐ 3-4 times / week
☐ 5-6 times / week	☐ 1 time / day	☐ 2 times / day	☐ ≥ 3 times / day

[5] **Thompson, F. E., Kipnis, V., Subar, A. F., Krebs-Smith, S. M., Kahle, L.L., Midthune, D., Potischman, N. and Schatzkin, A. (2000)** Evaluation of 2 brief instruments and a food-frequency questionnaire to estimate daily number of servings of fruit and vegetables. *American Journal of Clinical Nutrition Vol. 71, No. 6, 1503-1510*

19. On how many days in the month did you eat fruit for your meals or snacks? (Do not count juices).

☐ Never ☐ 1-3 days last month ☐ 1-2 days / week ☐ 3-4 days / week

☐ 5-6 days / week ☐ Every day

19. When you ate fruit in the last month, how many portions of fruit per day did you usually eat? (Count each piece or one-half cup you ate as one portion, whether it was one fruit or different fruits.)

☐ 1 portion of less ☐ 2 portions ☐ ≥ 3 portions

20. On how many days in the last month did you eat vegetables for your meal or snacks? (Do not count potatoes.)

☐ Never ☐ 1-3 days last month ☐ 1-2 days / week ☐ 3-4 days / week

☐ 5-6 days / week ☐ Every day

21. When you ate vegetables in the last month, how many total portions of vegetables per day did you usually eat? (Count each one-half cup you ate as one portion, whether it was one vegetable or different vegetables)

☐ 1 portion or less ☐ 2 portions ☐ ≥ 3 portions

22. Do you feel that your intake of fruit and vegetables has increased since taking up your allotment?

☐ Yes ☐ No

23. If yes, approximately how many <u>more</u> fruit and vegetables portions per day do you consume?

☐ 1 portion or less ☐ 2 portions ☐ ≥ 3 portions

SECTION D – PHYSICAL ACTIVITY[6]

The following questions concern your physical activity in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, at your house and garden, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. What physical activity level would you place allotment work as?

☐ Vigorous ☐ Moderate ☐ Gentle

2. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

☐ No vigorous physical activities → ***Skip to question 4***

3. How much time did you usually spend doing **vigorous** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

[6] Taken from International Physical Activity Questionnaire.(August 2002)Short last 7 days self-administered format. For use with young and middle-aged adults (15-69 years) retrieved from **www.ipaq.ki.se**

4. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ **days per week**

   ☐ No moderate physical activities → ***Skip to question 6***

5. How much time did you usually spend doing **moderate** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

6. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

   _____ **days per week**

   ☐ No walking → ***Skip to question 8***

7. How much time did you usually spend walking on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ **Don't know/Not sure**

This question is about the time you spent **sitting** on weekdays during the last **7 days.** Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

8. During the last **7 days, how** much time did you spend sitting on **a week day?**

_____ hours per day

_____ minutes per day

☐ **Don't know/Not sure**

9. Do you feel that your exercise levels have altered since taking up your allotment?

☐ **Yes** ☐ **No**

If yes, by how much?

_____ days per week

_____ hours per day

_____minutes per day

This is the end of the questionnaire. Thank you for participating.

Appendix 3 : Rationale for the questionnaire design

Question	Rationale	Study adapted from
Section A Demographics 1. Age ranges 2. Gender 3. Ethnic background 4. Living Arrangements 5. Residence type 6. Education level 7. Employment status	Age ranges picked to correspond to Stockport JNSA(2007) To adjust for sex, fruit and veg consumption varies with gender Fruit and vegetable consumption varies with ethnicity. Allotment owner demographics important	
Section B –Allotment Information 1. Length of time plot held 2. Frequency of attending 3. Hours at each visit 4. Alone or with family 5. Travel to plot 6. Reasons for ownership 7. Crops grown 8. Also purchase 9. Proportions grown 10. Where purchase from	Important factor to determine inclusion criteria and effect of time on actions Frequency of attending will affect physical activity levels Time spent at each visit may indicate physical activity levels, dependant on how time spent Indicates, knock on effect to children and family members health Is this also providing activity Qualitative indication of ownership , to evaluate if health is a reason To provide information on crops currently being grown in current climate conditions Can families be self sufficient with an allotment or is it only a 'top-up' To what extent has the allotment taken over as F & V provider Provides information on whether thinking about locally sourced foods	Edinburgh Council, (2007)

Climate Change 11. Climate change factors 12. Will it affect allotments 13. How soon 14. How will it affect 15. Crops plan to grow 16. What new crops 17. What crops can't grow	Establishes perceptions of climate change	Bisgrove and Hadley (2002**)**
Section C – Fruit and Vegetable Consumption. 1. Orange or Grapefruit in last month 2. Other fruit juice in last month 3. French fries or fried potatoes 4. Baked, boiled or mash 5. Days a month, eating fruit 6. No. of portions of fruit 7. Days a month eating veg. 8. No. of portions of veg. 9. Has intake altered, since allotment 10. How many portions a day?	Establishes a quantity of fruit and vegetables consumed in a monthly period in portions per day.	Thompson et al.(2000)
Section D- Physical Activity	Questions determine the physical activity over a period of a week and whether a difference is noted before and after allotment 'ownership'.	IPAC (2002)

Appendix 4 : Permissions from Allotment Sites Whitehill Allotment Society Permission

--Original Message-----
From: John Grimshaw <>
To:
Sent: Thu, 29 Oct 2009 16.38

Subject: RE: Allotment research

Ann,

I Do not know why the mail did not work, but hey ho!

We have about 65 members on plots - but again I could get around twenty (maybe) maximum involved - although thats a lot of data to crunch - also I happen to be the secretary for SMAGA - look up smaga.zoomshare.etc as per the whitehill address and see what we are about - I could put it to the floor and in our minutes to all member sites (most of the allotmetns by the way) across the borough if you wish - we can but try!

Hope this helps with the committee application.

John Grimshaw

-----Original Message-----
From: John Grimshaw <
To:
Sent: Thu, 29 Oct 2009 13:20
Subject: RE: Allotment research
Dear Ann,

I will pass this onto the rest of the officers of the committee this weekend, I cannot see any issues / problems myself - how many people would you need?

This is just so that I can get a ball park figure, as we could even put you in touch with them to save time.

A lot of people on allotments come for the plot and do not necessarily go in for things like this , although a lot still would I hasten to add.

Anyway, hopefully you can get back by tomorrow then we can take it from there after the weekend, have a chat and possibly you could come down and meet our Chairperson and a few others who may be interested.

Regards

John Grimshaw - PS the allotty mail re routes to this address - so please feel free to contact me here.

PRIESTNALL ALLOTMENTS AND GARDEN SOCIETY

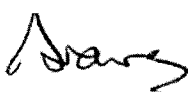
19 June
2009

Dear Ann,

Following our recent conversation regarding your research proposal, I am happy to give my consent to you to approach allotment holders at our site. This will be for the purpose of being members of a focus group and completing questionnaires.

I understand that participation will be on a voluntary basis and a decision for the individual.

Yours sincerely,



Mrs Fay Bravey

Secretary

Appendix 4 – Risk Assessment General

Risk Assessment Pro-forma

Assessment Undertaken By Ann Hunt		1 Page Of 2
Department /Location Biological Sciences - Chester		
Signed	Date : 30/09//2009	

Hazards Identified	Risk of or from & who is at risk	Control measures already in place	Further Actions Required	Review Date
Adverse weather	Rain, heat stroke, sunburn, dehydration. Researchers & participants	▪ Checking of weather forecasts	-Application of sun cream, -Waterproofs, -Drinking water.	30/09/2010
Transportation	Road traffic accidents. Researchers & participants	▪ Seat belts must be used at all times ▪ Car hire with insurance	-Limit journey times to that specified by University procedure. -Take regular breaks. -Alternate drivers.	30/09/2010

Overall planning and control	Miscommunication, lone work. Researchers & participants	▪ Mobile phones available for emergency use ▪ Insurance cover checked	Inform other researchers/ designated person of location at all times Interview in public places Take a 2nd researcher if possible.	30/09/2010
Public ignorance and apathy	Delay research Researchers	▪ Use alternate source of recruitment, eg internet sites		30/09/2010
Language barrier/communication gap	Delay research, misunderstanding Researchers & participants	Use of visual aids to assist in the interview		30/09/2010
Risk of causing psychological harm or physical harm	Researcher and perticipants	Follow interview procedure strictly and do not be drawn into other topic areas. Ensure participant s are aware of withdrawal at anypoint.		30/09/2010

References:-

Department of Health.[DOH} (2003) *The Research Governance Framework for Health and Social Care*. Draft 2nd Edition, HM Stationery Office, London,.

(2004)Notes on Good Practice for Research Organisations in the Management of a Portfolio of Trials 2: Assessment of risk. Retrieved from; www.ct-toolkit.ac.uk/_db/_documents/MPTrials2.pdf

Risk Assessment and Contact Details Form for Completion by Dissertation Students doing work off campus

This form should be completed by all level 3 undergraduate dissertation students and masters level students in the Department of Biological Sciences doing work anywhere other than on the premises of the University of Chester.
N.B. IF YOU DO NOT DO THIS FORM YOU MAY NOT BE INSURED

This form must be completed and signed by you the student & your supervisor and a copy must be given to Jane Dodd ***before*** starting work. (Jane is the laboratory manager in the Department of Biological Sciences, she is based in the Thomas Building preparation room). Jane should also check & sign the end of the form before filing it. Another copy should be put in your Research Journal.

Name: Ann Hunt

Address:

Phone number:
Mobile number ;
Supervisor: Basma Ellahi, Cynthia Burek

Next of kin:
Address and phone number (s) of next of kin……

Brief description of work to be carried out : Face-to Face interviews with allotment holders in the metropolitan borough of Stockport.

Site of study (give grid reference, address or area as appropriate) SK4

……..
……..

Nearest phone: mobile

Nearest doctor: Heaton Moor Medical Centre
Nearest hospital: Stepping Hill Hospital

For further information on risks please look on IBIS on Home Page » Schools and Departments » Estates » Health & Safety The Field Studies Management Portfolio and SCP 1/08 (Code for Field Studies) and Group Safety at Water Margins particularly have some useful guide lines. Staff should contact the Health & Safety Adviser (Stephen Povey) if they have any queries.

N.B. You must fill in all the sections in the column entitled: Tick each item or state N/A (N/A means does not apply).
CHECK THROUGH THE ITEMS ON THIS LIST THAT APPLY TO YOU BEFORE EACH VISIT OR TRIP.

Potential Hazards	Control measures for consideration	Tick each item or state N/A	For any item ticked describe the specific control measures/preparation or actions to be taken before each trip.
Adverse weather	Checking of weather forecasts & amend activities if possible	X	As the allotment site is outdoors, an alternative venue may need to be organised to carry out the interview
	Foul weather protection on kit list	X	
Transportation	Appropriate insurance cover in place	N/A	
	Seat belts must be used at all times	X	
	Driving hours limited as per University procedure	N/A	
	Appropriate breaks on long journeys	N/A	
	For all journeys See USE OF UNIVERSITY MINIBUSES AND CARS on » BI3001 - Dissertation » Online Learning for BI3001 »INFORMATION FOR STUDENTS DOING Dissertations 2006-7		
Equipment, clothing & substances	All clothing appropriate to activities & location, including use of waterproof clothing	X	Suitable wet weather clothing will be worn, wellingtons and waterproofs
	All equipment appropriate to the activities and location e.g. Appropriate footwear	X	
	Specialist equipment checked	N/A	
	Basic first aid kit if working in isolated or hazardous location	X	
	Appropriate medicines e.g. if asthmatic, hay fever sufferer etc.	X	A first aid kit will be taken to the site, along with antihistamines In case of insect bits
	Emergency arrangements include carrying the contact numbers for all helpers and the University.	X	
Overall Planning & control	Mobile telephones available for emergency use (consider network coverage).	X	The time of interview will always be known to another designated person and they will be contacted once the interview is complete. If possible a second researcher will be taken along. Interviews will always be conducted in a public place.
	Insurance cover checked. Supervisor should check with the Director of Services (Graham Fairlie) on specific concerns	X	
	Prior approval for adventurous activities re insurance & college policy	X	
	Arrangements made to be accompanied by another adult if intending to work any where with specific dangers, e.g. isolated, slippery, steep, working with unknown people etc.	X	
	If working alone in isolated or possibly dangerous places, arrangements made to inform another responsible adult when and where you are going, how you will inform them of your safe return, what time you will return and what they should do if you do not return by a specified time.	X	
Residential Visits or Visits abroad	Separate form completed. See Visits Abroad Checklist & Emergency Planning on IBIS Home Page » Schools and Departments » Estates » Health and Safety	X	

Specific risks linked to project	The student should discuss other possible risks with their tutor. These should then be described on a separate piece of paper giving precautions to be taken. Attach sheet to this form	X	

SIGNED (student) _____ SIGNED (supervisor) _____

DATE_____ SIGNED (Jane Dodd) _____

Appendix 4 : Ethical Approval

Faculty of Applied and Health Sciences

Research Ethics Committee

19 January 2010

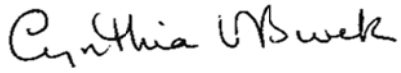
Dear Ann

Study title: **An exploration of food, physical activity and climate change perspectives in relationship to allotment ownership**
FREC reference:377/09/AH/BIOL
Version number: **2**

Thank you for sending the above-named application to the Faculty of Applied and Health Sciences Research Ethics Committee for review.
The application has been considered on behalf of the Committee by Nick Clitherow as Lead Reviewer and reported to the Faculty Research Ethics Committee.
On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form and supporting documentation.
The favourable opinion is given provided that you comply with the conditions set out in the attached document. You are advised to study the conditions carefully.
The final list of documents reviewed and approved by the Committee is as follows:

Document	Version	Date
Application Form	2	January 2010
List of references	2	January 2010
Summary CV for lead researcher	-	January 2010
Participant information sheet	2	January 2010
Consent form	2	January 2010
Written permission from allotment societies	-	2009
Piloted questionnaire	2	January 2010
Revised questionnaire	2	January 2010
Advertising materials	2	January 2010
Risk assessment	2	January 2010
Pre-screen questionnaire	2	January 2010
Pilot study questions	2	January 2010
Results summary of the pilot study	2	January 2010
Rationale to the questionnaire	2	January 2010
Study design	2	January 2010
Inclusion/exclusion criteria	2	January 2010
Power calculation	2	January 2010

With the Committee's best wishes for the success of this project.
Yours sincerely,



Prof. Cynthia Burek
Chair, Faculty Research Ethics Committee

Enclosures ***Standard conditions of approval.***

c.c. Supervisor
FREC Representative

Appendix 5:Statistics

Inclusion Criteria;

- Age 18+
- They are not vegetarian
- They do not smoke
- Allotment 'owner' for 6 months or more

Exclusion Criteria;

Any individuals...

- with a condition which affects their diet, appetite or satiety
- with any food allergies, intolerances or restrictions
- who are taking any medications or supplements likely to affect their appetite
- who have prior knowledge of the study
- who have nutrition training

Appendix 5: Power Calculation

One group t test that a mean equals user specified value

Column	1
Test significance level, α	0.050
1 or 2 sided test?	2
Null hypothesis mean, μ_0	2.700
Alternative mean, μ_a	3.920
Standard deviation, σ	1.700
Effect size, $\delta = \lvert\mu_a - \mu_0\rvert / \sigma$	0.718
Power (%)	95
n	28

REFERENCES for MOTD-1:

O'Brien, R.G., Muller, K.E. Applied Analysis of Variance in Behavioral Science Marcel Dekker, New York (1993) Chapter 8 pp. 297-344

Appendix 5 -Daily frequency conversion for questionnaire

Questionnaire response	Daily frequency
Never	0
1-3 times/month	0.067
1-2 times/week	0.214
3-4 times/week	0.5
5-6 times/week	0.786
1 time / day	1
2 times per day	2
3 times per day	3
4 times per day	4
5 times per day	5